MEASURING *made* EASY:
OR, THE
Deſcription and Uſe
OF
COGGESHALL's
SLIDING-RULE.

CONTAINING
Inſtructions for Meaſuring all Manner of Timber, both by the Common Way, and the True Way: With Directions for taking the Dimenſions of Trees, and the Allowance for Bark, *&c.* perform'd both by the Rule, and by Arithmetick; by which may be meaſured all Manner of Superficies; as, *Board*, *Glaſs*, *Plaiſtering*, *Painting*, *Wainſcotting*, *Tyleing*, *Paving*, *Land*, *&c*, both by the Rule and Arithmetick.

Whereunto is now added,
The Deſcription of *Scamozzi's* Lines, with their Uſe in finding the Lengths and Angles of Rafters, Hips, Collar-Beams, *&c.*

By J. GOOD, *Teacher of the Mathematicks*.

Carefully Corrected, and much Enlarg'd
by *J. Atkinſon*, Sen.

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BRITISH MUSEUM

TO THE READER.

I Here preſent you with ſome Fruits of my ſpare Hours, wherein I have endeavoured to render the Uſe of the Sliding-Rule *more Plain and Eaſy than ever it appeared before.*

I have here delivered in a few Rules, but yet in a Plain and Eaſy Manner, Problems for the meaſuring all manner of Regular Figures, *and* Plain Superficies, *ſuch as* Board, Claſs, Painting, Plaiſtering, Paving, Tyleing, Joyners *and* Maſons *Works,* &c. *and that both by the* Sliding-Rule, *and by* Arithmetick.

In the next Place you have Directions for the Meaſuriug all manner of Timber or Stone, by the Sliding-Rule, *and* Arithmetically, *by a new Method, whereby the true Content of Round Timber or Trees, may be found.*

I remain a Well-Wiſher to the Mathematicks.

JOHN GOOD.

CHAP. I.

The Deſcription and Uſe of Coggeſhall's RULE.

THIS *Rule* is fram'd three Ways; *Sliding* by one another, like *Glaſier's Rules*; *Sliding* on one ſide of a *Two-Foot Joint-Rule*; and one part *Sliding* on the other, in a Foot long, the back part being flat, on which are ſundry *Lines* or *Scales*.

Upon the foreſaid *Sliding-ſide* of the Rule, are Four Lines of *Numbers*, three are *Double-lines*, and one a ſingle *Line of Numbers*; marked in the *Figure* annexed, with A, B, C, and D.

The three marked A, B, and C, are called *Double Lines of Numbers*; being figur'd 1, 2, 3, 4, 5, 6, 7, 8, 9. Then, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 at the End.

That marked D, is the *Single Line of Numbers*, and figur'd thus, 4, 5, 6, 7, 8, 9, 10, 20, 30, and 40 at the End, even with and under 10 in the *Double-line* next to it, this is called the *Gert-line*, and is ſo marked in the *Figure*.

The Figures on the Three *Double-lines of Numbers* may be encreaſed or decreaſed at pleaſure; thus, 1 at the Beginning may be called 10, 100, or 1000, then 2 is 20, 200, or 2000, ſo that when one at the Beginning is 10, then 1 in the middle is 100, and then 10 at the End is 1000; but if 1 at the Beginning is counted for 1, then 1 in the Middle is 10, and 10 at the End is 100.

And as the Figures are altered, ſo muſt the Stroaks or Diviſions between them be altered in their Value according to the Number of the parts they are divided into: As thus, from 1 to 2 its divided into 10 parts, and each Tenth, is divided into 5 parts, and from 2 to 3 it's divided into 10 parts, and each Tenth into two parts, and ſo on from 3 to 5; then from 5 to 6, it's divided into 10 parts only; and ſo on unto 1 in the Middle of the *Rule*, or the Firſt Part of the *Double Line of Numbers.* The *Second Part*, or *Radius*, is divided like the *Firſt Radius.*

The *Gert* Line marked D, is divided from 4 to 5 into 10 parts, and each Tenth into 2 parts, and ſo on from 5 to 10, then from 10 to 20, it's divided into 10 parts, and each Tenth is divided into 4 parts; and ſo on all the way from 20 to 40 at the End, which is right againſt 10 at the End of the *Double Line of Numbers.*

The Lines on the Back-ſide of this *Rule* that ſlides on one Side, are theſe, a Line of *Inch Meaſure* from 1 to 12, each Inch divided into Halfs, Quarters, and Half Quarters; another Line of *Inch Meaſure* from 1 to 12, each Inch divided into 10 Equal Parts; and a *Line of Foot Meaſure* being one Foot divided into 100 Equal Parts, and Figur'd 10, 20, 30, 40, 50, 60, 70. 80, 90, and 100 even with 12 on Inch Meaſure.

And the Back-ſide of the *Sliding Piece* is divided into Inches, Halves, Quarters, and Half Quarters, and figur'd from 12 to 24; ſo that it may be ſlid out to 2 Foot to meaſure the Length of a Tree, or any thing elſe you have occaſion to meaſure.

Note, The *Line of Foot-meaſure* turns Inches, Halves, Quarters, &c. into Decimal parts of a Foot, which is moſt ready for Meaſuring by this *Rule*, as alſo by Arithmetick; and it's made fully out in the Table following.

A TABLE *Reducing Inches, Halves, Quarters, and Half-Quarters, into Decimal Parts of a Foot; Or, reducing Inch-Meaſure into Foot-Meaſure.*

Inches	Decimal.	Parts of an Inch.						
		$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
0	.000	.010	.021	.031	.042	052	.062	.073
1	.083	.094	.104	.115	.125	.135	.146	.156
2	167	.177	.188	.198	.208	.219	.229	.24
3	.25	.26	.271	.281	.292	.302	313	.323
4	.333	.344	.35	.365	.375	.385	.396	.406
5	.417	.427	.438	.448	.458	.469	.479	.49
6	.5	.51	.521	.531	.542	.552	569	.573
7	.583	.594	.604	615	.625	.635	646	.656
8	.667	.677	.688	698	.708	.719	.729	.74
9	.75	.76	.771	.781	.792	.802	.813	.823
10	.833	.844	.854	.865	.875	.885	89	906
11	.917	.927	.937	.948	.958	.969	.979	.99

By this *Table* $\frac{1}{8}$ or Half Quarter of an Inch in *Foot Meaſure*, or Decimals, is .01, or $\frac{1}{100}$ part of a Foot; $\frac{1}{4}$ of on Inch is .021, or ſhorter .02, that is $\frac{2}{100}$ parts of a Foot; and ſo on in the upper Line of the *Table*. And in the next Line under it, 1 Inch is

.083 or $\frac{8}{100}$ of a Foot; Inch $1\frac{1}{8}$ is ,094 or $\frac{9}{100}$; Inch $1\frac{1}{4}$ is, 104 or $\frac{1}{10}$; Inch, $1\frac{3}{8}$ is.115, or $\frac{11}{100}$ of a Foot, and ſo on: And in the Firſt Column under Decimals 1 Inch .083; 2 Inches .167;, 3 Inches is .25; 4 Inches .333; and ſo on to 11 Inches is .917 or $\frac{92}{100}$ All theſe may be found on the *Line of Foot-Meaſure* on the Backſide of the Rule.

CHAP. II.

The Uſe of the Double Scale, *ſhewing how to find the Area of any Plain Superficies*; *and alſo* Arithmetically.

PROB. I. *To meaſure a Geometrical Square.*

BY the *Sliding-Rule.* Let there be a Square whoſe Sides are each three Feet and a half. Set 1 on the Line B, to 3 and $\frac{1}{2}$ on the Line A, then againſt $3\frac{1}{2}$ on the Line B, is $12\frac{1}{4}$ Feet on the Line A, which is the Content of ſuch a Square.

1	2	3	*a*
4	5	6	*b*
7	8	9	*f*
c	*d*	*e*	*g*

Arithmetically.

F. Par.
The Side of the Square, Feet $3\frac{1}{2}$ or ——— 3.5
Multiplied by it ſelf —— ——— ——— 3.5
175
105
The Product is ——— ——— ——— Feet 12.25

This Arithmetical Operation is thus performed, multiply the Side of the Square, namely $3\frac{1}{2}$, or $3\frac{5}{10}$ into it ſelf, the Product is 1225, from which cut off 2 places, becauſe there are 2 Decimals in both Fractions, and it will ſtand thus $12\frac{25}{100}$; which is 12 Feet and a quarter.

Note, The Figure it ſelf ſhews the Content in Feet by inſpection, for if you tell the greater Squares, you ſee they are 9 in Number; *a* and *b*, makes 10; *c* and *d* makes 11; *e* and *f*, makes 12; and the little Square *g* in the Corner, makes one quarter of a Foot. which is in all 12 Feet.

More Examples by the Rule.

Length of the ſide	$5\frac{1}{4}$	Feet	$27\frac{1}{2}$	Feet
Length of the ſide	$7\frac{1}{2}$	Feet	$56\frac{1}{4}$	Feet
Length of the ſide	$10\frac{3}{4}$	Feet	$115\frac{1}{2}$	Feet
Length of the ſide	13	Feet	169	Feet

PROB.

PROB. II. *To meaſure a* Long-Square *by the* Sliding-Rule; *and alſo by* Arithmetick.

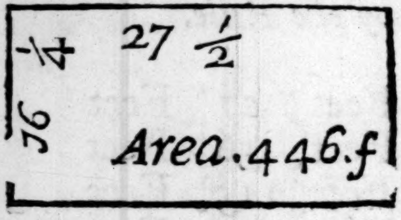
LET there be a Long Square, whoſe longeſt ſide is 27 Feet and a half, the ſhorteſt 16 Feet and a quarter: ſet 1 on the Line B, to 16¼ on the Line A, then againſt 27½, on the Line B, is 446⅞ Feet, the Content of the Long Square on the Line A.

By Decimal Arithmetick.

Multiply the Length by the Breadth, and from the Product cut off as many Places to the Right-hand as there are Decimals in the Length and Breadth; the Integers remaining to the Left-hand are the ſquare Feet.

Example. *F. Par.*

Length 27½ Feet or ——————— 27.50
Breadth 16¼ Feet or ——————— 16.25



13750
5500
16500
2750
446.8750

But

But Contracted thus.	F. Par.
Breadth Feet 16$\frac{1}{4}$ or in Decimals —	16.25
Length Feet 27$\frac{1}{4}$ or 27.25 inverted is —	5.72
	3250
	1137
	81
The Product is the Content req. Feet	446.8

In this *Contracted Way*, Multiply each Figure of the Inverted Number (beginning at the Right-hand) by the Figure over it, and putting the ſeveral Multiplications even at the Right-hand, as above: Thus, multiplying by 2, the Product is 3250: Then ſay 7 times 5 is 35, leave out 5 and carry 3 in your Mind, then ſay 7 times 2 is 14, and 3 I carried makes 17, ſet 7 juſt under the 0, and carry the 1 in your mind; ſaying 7 times 6 is 42, and 1 I carried makes 43, ſet 3 under 5 and carry the 4 in your mind; and ſo on to the End of that Line: Then ſay 5 times 2 is 10, reject the 0, and carry 1 in your mind; then ſay 5 times 6 is 30, and 1 I carried makes 31, ſet 1 juſt under the 7, and carry the 3 in your mind; ſaying 5 times 1 is 5, and 3 I carried makes 8, ſetting it under the 3, and multiplying is done: Then add them together and it's 446.8; that is Feet 446$\frac{8}{10}$ or 446$\frac{3}{4}$ as before.

Note, Where the Units place of the inverted Number ſtands, ſo many places are to be cut off in the Product: As in this Example, 7 the Units place, when inverted ſtands under 2, the firſt place in Decimals, and therefore one place muſt be cut off in the Product at the Right-hand; ſo that the Product 4468 muſt be 446.8 or 446$\frac{8}{10}$; obſerve the like in all that follows.

More Examples by the Sliding-Rule.

		Contents
Breadth 11$\frac{1}{2}$ Feet	Length 15 $\frac{1}{2}$	174$\frac{1}{4}$ Feet
Breadth 17$\frac{1}{4}$ Feet	Length 21 $\frac{1}{2}$	371$\frac{3}{4}$ Feet
Breadth 22$\frac{3}{4}$ Feet	Length 19 $\frac{3}{4}$	676$\frac{1}{4}$ Feet

PROB. III. *How to meaſure a* Rhumbus *by the* Sliding Rule.

SUppoſe the Side of a *Rhumbus* be 8 Feet 6 Inches and a quarter, and the Breadth, or Line AB, 8 Feet 4 Inches and a half: That is the Length is Feet, 8$\frac{52}{100}$ and Breadth is Feet 8$\frac{38}{100}$. Set 1 on the Line B, to 8 Feet $\frac{52}{100}$ on the Line A; then againſt 8 Feet $\frac{52}{100}$ on the Line B, is 71 Feet $\frac{40}{100}$ parts of a Foot on the Line A; now if you would find the Value of the Decimal, or part of the Foot, look for $\frac{40}{100}$ on your *Rule*, and you will find againſt it 4$\frac{3}{4}$ Inches, ſo that the Content of this *Rhombus* is 71 Feet 4$\frac{3}{4}$ Inches.

By Decimal Arithmetick.

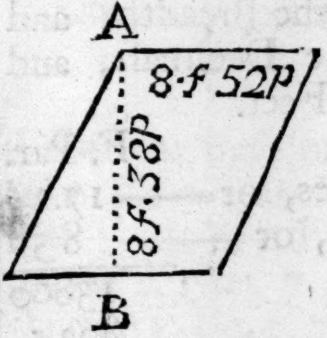
Multiply the Breadth AB, by the Length of any of the Sides, and from the Product cut off as many Places to the Right-hand as are Decimals in the Length and Breadth, the Integers remaining to the Left-hand are the ſquare Feet requir'd.

Example. *F. Par.*

The Length Feet 8.06¼ Inches, or —— 8.52
Breadth AB, Feet 8.04½ Inches, or —— 8.38

6816
2556
6816

The *Content* is *Feet* 71.3976
or 71 *Feet* 4¾ *Inches.*



And Contracted is thus,

F. Par.
Length Feet 8.06 Inches 8¼ is in Decim. 8. 52
Breadth AB, Feet 8.04 Inches and ½ is } 8.38
8.38 inverted is ——— ——— }

6816
255
68

The *Content* required as before is *Feet* 71.39

PROB.

PROB. IV. *How to meaſure a* Rhomboide *by the* Sliding-Rule.

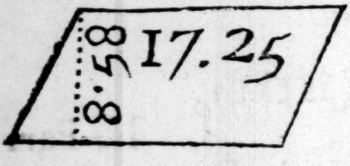
ADmit the Length of a *Rhomboide* be 17 Feet 3 Inches, or $17\frac{25}{100}$, and the true Breadth 8 Feet 7 Inches, or $8\frac{58}{100}$, what is the Content? Set 1 on the Line B, to 17.25 on the Line A; then againſt 8.58 on the Line B, is 148 Feet on the Line A.

By Decimal Arithmetick.

Multiply the Length by the Breadth, and from the Product cut off the Decimals, and the Remainder is the Square Feet.

Example. F. Par.
The Length 17 Feet 3 Inches, or —— 17.25
The Breadth 8 Feet 7 Inches, or —— 8 58

13800.
8625
13860



The *Content* is Ft. 1480050
or 148 Feet.

By Contraction thus, *F. Par.*
Length 17 Feet 3 Inches in Decimals — 17.25
Breadth 8 Ft. 7 Inch. or 8.58 inverted is — 85.8

13800
862
138

The Content as before is —— Feet 148.00.

PROB.

PROB. V. *How to meaſure a Triangle by the* Sliding-Rule.

Theorem. EVery Triangle is half of that Long-Square whoſe Length and Breadth is equal to the Perpendicular and Baſe. Therefore from the greateſt Angle let fall a line Perpendicular, to the ſide (oppoſite to the greateſt Angle) called the Baſe: and then to find the Content of any Triangle, take half the Length of the Baſe and the whole Perpendicular; or half the Length of the Perpendicular, and the whole Baſe.

Example.

Let the Baſe of a Triangle be 4 Feet, $\frac{15}{100}$ or 4 Feet 1 Inch $\frac{3}{4}$, and the *Perpendicular* 2 Feet $\frac{15}{100}$, or 2 Feet 1 Inch $\frac{3}{4}$, the half of the one is 2 Feet 7 parts, and the half of the other is 1 Foot 7 parts; ſet 1 on the Line B, to 4.15 on the Line A, then againſt 1.07, half the *Perpendicular* on the Line B, is 4 Feet and almoſt half for the Content. Or if you ſet 1 on the Line B, to 1.07 on the Line A; againſt 4.15 on the Line B, is 4 and almoſt a half on the Line A. Again, another way, if you ſet 1 on the Line B, to 4.1 on the Line A; then againſt 2.15 on the Line B, is 8 Feet $\frac{9}{10}$ (which is about 11 Inches) on the Line A, the half thereof is 4 Feet 5 $\frac{1}{2}$ Inches, which is the *Content* of the Triangle.

By Decimal Arithmetick all the three Ways.

F. Par.

1ſt Way { The whole Baſe is —— —— 4.15
The half Perpendicular is —— 1.07

2905
415

The Content 4 Ft. 5½ Inches, or Ft. 4.4405

2d Way { The whole Perpendicular —— 2.15
The half Baſe —— —— 2.07

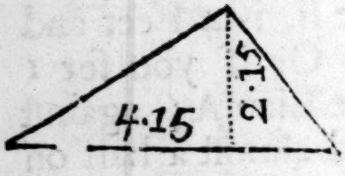
1505
430

The Content 4 Feet 5½ Inches, or Feet 4.4505

3d Way { The whole Baſe —— —— 4.15
The whole Perpendicular 2.15

2075
415
830

The Product is Feet 8.9225



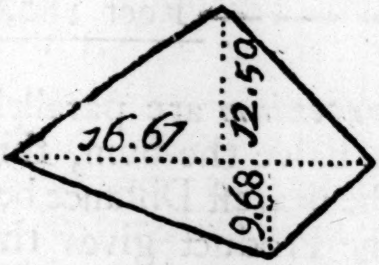
The half is Feet 4.4612
The *Content* is 4 Feet 5 Inches and ½, as beſore.

By

By Contraction thus,	F. Pa.
The whole *Baſe* ———————	4.15
Whoſe *Perpendicular* 2.15 *Inverted* is ——	51.2
	830
	41
	21
The Product is ———————	8.92
Half is the Cont. 4 Feet 5½ Inc. as beſore	4.46

PROB. VI. *Of the Meaſuring a* Trapezium.

A *Trapezium*, is a Figure of 4 Sides, but is not a *Square*, a *Long-ſquare*, a *Rhombus*, nor a *Rhomboides*; which before it can be meaſured muſt be divided into Triangles, by a Line from one Corner to his oppoſite one, through the *Trapezium*; ſo will the two Perpendiculars fall from the other two Angles upon this Diagonal, or Croſs-line; then the *Content* of the Figures are to be ſound by the laſt *Problem.*



Example, Suppoſe the Dimenſions of a *Trapezium* were as followeth, the Baſe is 16 Feet 8 Inches, the one Perpendicular 12 Feet 6 Inches, and the other 9 Feet 8 Inches, what is the Content?

Decimally.

F. Par.
One Perpendicular 12 Feet 6 Inches or 12.50
The other 9 Feet 8 Inches, or ——— ——— 9.68
The Sum is ——— ——— ——— 22.18
The half Sum is ——— ——— ——— ——— 11 09
Multiplied by the whole Baſe ——— 16.67
7763
6654
6654
1109
The *Content* 184 Ft. 10½ Inc. or Feet 184.8703

By *Contraction* thus :

F. Par.
½ Sum of the two Perpen. 11 F. 1 In. or 11.08
Baſe 16 *Feet*. 8 *Inch*. or 16.67 inverted is 76.61.
11.08
665
67
8
The *Content* as before is ——— ——— Feet 184.8

Note, If 2 ſides of a *Trapezium* are parallel, add them together, and halve the Sum, this half Sum multiplied by the neareſt Diſtance betwixt thoſe two ſides, the Product gives the Content. Or if you meaſure it in the middle betwixt thoſe two Lines, that are parallel, it will be the ſame.

PROB.

PROB. VII. *To meaſure any Regular Figure.*

OF theſe *Regular Figures* there are ſeveral ſorts, as the *Pentagon*, contained under five ſides; the *Hexagon*, contained under ſix ſides; the *Heptagon*, contained under ſeven ſides; and the *Octagon*, contained under eight ſides, *&c.*

Now to meaſure any of theſe ſorts of Figures practically, it is by dividing them into Triangles, which is done by drawing Lines from the *Center* of the Figure to every Angle, then from the *Center* to the middle of any one of the Triangles ſides, draw a Line, which Line is the Perpendicular. Having the Perpendicular and Baſe of any of theſe Triangles (by *Prob.* 5.) find the *Content* of one Triangle, and that multiplied by the Number of Triangles, finds the *Content* of the Figure.

Note, To find the *Center* of any Regular Figure, of even Number of ſides, draw a Line from one Angle to its oppoſite, the middle of which is the *Center*; but if your Figure have any odd Number of ſides, as 5, or 7, *&c.* draw Lines from any two Angles to the middle of their oppoſite ſides, their Interſection is the Center.

CHAP. III. *The Uſe of the* Girt-line, and *Line of* Numbers, *called the* Double-ſcale, *in meaſuring of Circles and their Parts.*

Prob. I. LET the Diameter of a Circle be 2 Feet $\frac{25}{100}$, to find the *Content*, ſet 11 on the *Girt-line* D, to 95 on the *Double-line* C; then againſt 2 Feet $\frac{25}{100}$ on the *Gert-line*, D is 3 Feet $\frac{98}{100}$ on the *Double-ſcale* of *Numbers* C, which is the Content.

Arithmetically.

The Rule. Multiply the Diameter in Inches by it ſelf, and then by this fixt Number .7854, and from the Product cut off from the Right-hand 4 Figures, the Remainder to the Leſt-hand is the *Content* of the *Circle* in Inches, which divided by 144, gives the Feet, and the Remainder, if any, divide by 12, gives the *Inches*.

Example.

```
The Fixt Number————————————7854
The Diameter multiplied —————729 Inches
                               ————
                              70686
The Diameter  27 Inches      15708
The Diameter  27 Inches     54978      F. In.
             ————          ——————————
              189        144(572.5566(3.11
              54             432
             ————           ————
Diam. multipl.729  Inc.   12)140
                              12
                            ————
                             021
                            ————
                             012
                            ————
                              09
```

The *Content* is 3 Foot 11 Inches ¼

The Rule may be thus, Multiply the Diameter in *Foot-meaſure* by it ſelf, the Product is called the *Square of the Diameter*, then multiply by the fixt Number 0.7854 in the *Contracted way*, and this laſt Product is the *Content* required, as follows. F. Par.

The Diameter 2 Feet $\frac{25}{100}$ or ——— 2.25
The Diameter 2 Feet $\frac{25}{100}$ inverted is — 52.2
450
45
11
The Square of the Diameter is Feet —— 5.06
The fixt Number 0.7854 inverted is —— 4587
3542
405
25
2
Content 3 F. 11 Inch. $\frac{3}{4}$ almoſt, or Feet 3 9.74

PROB. II. *To find the Content of a Semicircle.*

BY having the Diameter by the laſt *Problem*, find the *Content* of the whole *Circle*, the half thereof is the *Content* of the *Semicircle*. I think this needs no Example.

PROB. III. *To find the Content of a Quarter of a Circle commonly called a* Quadrant.

Example. THERE is a Quadrant, whoſe Semidiameter is 7 Feet, and the Circuit of the Arch is 11 Feet, what is the *Content?* Set 1 on the Double-line B, to 7 the Semidiameter on the Double-line A, then againſt 5 Feet $\frac{50}{100}$ (which is half the Circuit of the Arch) on B, is 38$\frac{1}{2}$ on A, the *Content* 38 *Feet* 6 *Inches*, or 38 $\frac{5}{10}$.

PROB. IV. *To find the Content of a Sector of a Circle.*

The Rule. SET 1 on the Double-line, to the *Semidiameter* on the Double line, then againſt half the *Circuit* of the Arch on the Double-line, is the *Content* on the other Double-line. This needs no *Example.*

PROB. V. *How to meaſure the Segment of a Circle.*

A *Segment of a Circle*, is a ſtrait Line drawn thro' the *Circle*, but not thro' the Center, it divides a Circle into two Parts or Segments; and the leſſer is thus meaſured. Let the *Sector* be meaſured, whereof the Segment is part, then ſubtract the Triangular Part, the Remainder is the *Content* of the Segment: But to the greater Segment, the *Content* of the Triangle included is to be added.

CHAP. IV.

The Uſe of the Double Scale; *ſhewing how to meaſure all manner of Superficies; as Board, Glaſs, Painting, Plaiſtering, Wainſcotting, Tyleing, Paving,* &c. *by the* Sliding-Rule, *and Arithmetically.*

1. *In meaſuring Boards.*

PROB. 1. Let there be a *Board* whoſe Breadth is 27 *Inches* $\frac{1}{2}$, or $27\frac{50}{100}$, and the Length 15 Foot $\frac{1}{4}$ or $15\frac{25}{100}$, what is the *Content* by the *Sliding Rule.*

Example.

Set 12 on the *Double Scale* B, to $27\frac{1}{2}$ on the *Double Scale A*, then againſt $15\frac{1}{4}$ Feet on the *Double Scale* B, is 35 Feet, the *Content* on the *Double Scale* A.

Decimally.

The Rule. Multiply the Length in Feet by the Breadth in Inches, and cut off ſo many Figures from the Right-hand, as are Decimals in your Length and Breadth, the Remainder divided by 12, the Quotient is the Feet and the Remainder (if any) the odd Inches.

Example. Length is——*Feet* 15.25
Breadth is —— —— *Inches* 27.50

76250
10675
3050 F. In.
12)41937 50(34.11
36

059
The *Content* is 34 *Ft.* 11 *Inch.*—48

11 *Inches*

The Length 15 Feet $\frac{1}{2}$, or —— Feet 15.25
Breadth 27 *Inch.* $\frac{3}{4}$, or 27.5 inverted is——5.72

3050
1068
76

Product is 419 *Inch.* $\frac{4}{10}$ as before, *Inches* 4194

But if the Breadth be taken in *Foot-meaſure*, it's done without Diviſion as follows,

F. Par.
The Length as before, 15 Feet $\frac{1}{4}$, or—— 15.25
Breadth 27 *Inch.* $\frac{1}{2}$, or 2 Ft. $\frac{29}{100}$ inverted 92.2

3050
305
137

Content is 34 *Ft.* 11 *Inch.* as before, or *Ft.* 34.92

And by the Sliding Rule it's thus: Set 1 on the *Double Scale* B, to 22.9 on the *Double Scale*

Scale A; then againſt 15.25 on the *Double Scale* B, is almoſt 35 feet on the *Double Scale* A, the *Content* as before.

Or, by the *Rule of Practice*, when the Length is in *Feet* and *Inches*, and the Breadth alſo in the ſame, counting for 1 Foot in Breadth, the whole Length is the *Content*, and for the Inches, according to its Aliquot parts of a Foot or 12 Inches; as it follows, in the laſt *Example*.

A Board whoſe Length being 15 *Feet* 3 *Inches*, and Breadth 27 *Inches* ½ or 2 *Feet* 3 *Inches* ½.

	F. Inch.
The Length ——— ——— ——— ———	15.03
Set it down again ——— ——— ———	15 03
Divide by 4, becauſe 3 *Inc.* is ¼ of a *Foot*	3.09¾
Div. the laſt by 6, becauſe ½ *In.* is ⅙ of 3 *In.*	0.07¾
And altogether is the *Content* required	34.1[illegible]½

In like manner the *Examples* following may be done, both by the *Foot Meaſure*, and by this *Rule of Practice*, which is worth the Learner's minding.

More Examples.

The Breadth 9 Inch.	Length 13 Feet	Con. 9 Feet ¾
The Breadth 21 Inch.	Length 19 Feet	Con. 33 Feet ¼
The Breadth 25 Inch.	Length 29½ Feet	Con 61 Feet ½

PROB. II. *Another Way when the Dimenſions are Feet and Parts, and the Content is required in Feet and Parts, by the* Sliding Rule.

Let there be a Board whoſe Length is 24 Feet $\frac{3}{4}$, and the Breadth 1 Foot $\frac{1}{2}$, what is the *Content*? *Example.*

Set 1 on the *Double Scale* B, to 1$\frac{1}{2}$ on the *Double Scale* A; then againſt 24$\frac{3}{4}$ on the *Double Scale* B, is 37 Feet $\frac{1}{10}$ on the *Double Scale* A, which is the *Content.*

More Examples.

Breadth 3$\frac{1}{4}$ feet	Length 20 feet	65	feet
Breadth 7$\frac{1}{2}$ feet	Length 25 feet	187$\frac{1}{2}$	feet
Breadth 12 feet	Length 30 feet	360	feet
Breadth 15 feet	Length 35 feet	525	feet

How to work this ſecond *Problem Decimally*, as is taught *Chap.* 2. *Prob.* 2.

Example	F. Par.
Length	24.75
Breadth	1.50
	123750
	2475
Content is 37 *Ft.* $\frac{1}{8}$ or 8 *Inch.* $\frac{1}{2}$ or *Feet*	37.1250

And by *Contraction* thus, the ſaid *Example.*

	F. Par.
Length 24 Feet $\frac{3}{4}$, or	24.75
Breadth 1 Foot $\frac{1}{2}$, or 1.5 inverted is	5.1
	2475
	1237
The *Content* 37 *Feet* 1 *Inch* $\frac{1}{2}$, or *Feet*	37.12

Ex-

Examples Decimally Contracted.

Breadth 4.27	Leng. 06.21	$26\frac{51}{100}$	or	26 feet 6 Inc.
Breadth 8.46	Leng. 11.32	$95\frac{77}{100}$	or	95 feet 9 Inc.
Breadth 12.54	Leng. 15.35	$92\frac{48}{100}$	or	192 feet 5 Inc. $\frac{7}{8}$
Breadth 16.74	Leng. 21.42	$358\frac{57}{100}$	or	358 feet 6 Inc. $\frac{7}{8}$

PROB. III. *Directions for the meaſuring of moſt ſorts of Artificers Works, and firſt of Glaziers Work, with the Manner of taking Dimenſions.*

THE beſt way to meaſure *Glaziers Work* is by the *Sliding Rule*, and the Dimenſions are taken very exact even to $\frac{1}{2}$ of an Inch; they commonly agree for their Work by the Foot, whether the *Glaſs* be Old or New, Squares or Quarries. *Note*, Saſh-Windows are glazied by the Square; that is, they tell how many Squares there be in all the Lights, and then reckon what they come to at ſo much the Score, or Dozen.

PROB. IV.

Let there be a Pane of Glaſs 29 $\frac{1}{2}$ *Inches long, and* 7 *Inches broad; what is the Content?*

Example.

By the *Sliding-Rule.* Set 144 (repreſented by 1.44) on the Line B, to 7 Inches on the Line A, then againſt 29$\frac{1}{2}$ on the Line B, is 1 *Foot* and almoſt a half on the Line A, or *Decimally* 1 Foot $\frac{44}{100}$.

More

More Examples.

Breadth	3½ Inch	Length	20¼ Inch	49 parts,	or 5 In. ⅞
Breadth	5¼ Inch	Length	25½ Inch	92 parts,	or 11 In. ¼
Breadth	9¾ Inch	Length	30¾ Inch	2 feet	1 Inch ¼
Breadth	13¼ Inch	Length	35 Inch	3 feet	2 Inches, ⅗

The foregoing Problem Arithmetically.

Multiply the Length in Inches and Parts, by the Breadth in Inches and Parts, and from the Right-hand of the Product cut off ſo many Figures as are Decimals in the Length and Breadth (if there be any) and the Remainder divide by 144, the Quotient is the Feet, and if any thing remain, divide it by 12, the Quotient is *Inches*.

Example.

In Par.

Length in Inches and Parts ——— 29.5
Breadth in Inches and Parts ——— 7.0

144)206.50(1.5
144
12(062(5 Inches
60

The *Content* is 1 *Foot* 5 *Inches* — 02
and Remainder 2

To perform this *Decimally*, without *Diviſion*.

Take the Length and Breadth in Foot meaſure, and then it's thus;

Example. F. *Par.*
The Length 29 Inches ½, or —— —— 2.46
The Breadth 7 Inches or 0.58, inverted is 85

1230
197

The *Content* is 1 *Foot* 5 *Inch.* ¼, or *Feet*—1.427

After the ſame manner may all the foregoing Examples be wrought.

PROB. V. *Directions for meaſuring* Joyners *and* Painters *Work*; *with the manner of taking their Dimenſions.*

Joyners and *Painters Work*, are generally agreed for by the Yard, and therefore having caſt up their Dimenſions, they bring the whole Sum into Yards, by dividing the Feet by 9.

Now in taking the Dimenſions of *Joyners*, or *Painters Work*, ſuch as *Pollection*, and *Bead-work*, you muſt by a Line girt Bends and Hollows, and ſo bring it down to the Bottom, after which meaſure the Length of the Line by your Rule, ſetting it down for one of the Dimenſions, then meaſure the Length of the former Height, and ſet it down for a ſecond Dimenſion.

Note, That in *Joyners Meaſure*, *Window-ſhuts*, and *Doors*, are *Work* and *half*, becauſe they are workt on both ſides.

The Paintings of Windows are generally agreed for by ſo much the *Light*, and *Caſements* at ſo much a *Caſement*:

In *Joyners* and *Painters Work*, Deductions are made for all *Windows* and *Chimneys*.

Example.

A *Joyner* hath wainſcotted a Room 44 Feet and a half in Compaſs, 9 Feet 3 quarters in Height; what is the Content by the *Sliding-Rule*?

Set 1 on the *Double Scale* B, to 44 Feet ½ on the *Double Scale* A, then againſt 9 Feet three quarters on the *Double Scale* B, is 433 Feet $\frac{9}{10}$ on the *Double Scale* A, the *Content*: Or thus, ſet 9 on the Line B, to 44½ on the Line A, then againſt 9¾ on the Line B, is 48 Yards on the Line A, which is the Content.

Decimally. F. Par.

The Compaſs of the Room 44.50

The Height ——— —— —— 9 75

22250

31150

40050 yds. feet in.

9)433.8750(48 01 0½

36

The *Content* is 48 *Yards* 073

1 Foot 10 Inches ½ 72

01

And by *Contraction*, the ſaid *Example* is thus,

	F. Par.
The Compaſs of the *Room*, 44 Feet ½ is —	44.5
The Height 9 Feet ¾ or 9.75, inverted is	57.9
	4005
	311
	22
The Product is —— ——	Feet 433.8
The Feet multiply'd by 0.111, invert. is	111.0
	4338
	434
	43
The *Content* as before in *Yards* is ——	48.15

How to meaſure Painters Work by the Sliding-Rule.

Example. There is a piece of Painting 13 Feet ½ broad, and 23 ½ Feet long. Set 9 on the *Double Scale* B, to 13 ½ on the *Double Scale* A, then againſt 23 ½ on the *Double Scale* B, is 35 Yards ¼ on the *Double Scale* A, which is the *Content* of ſuch a piece of *Painting*.

Decimally.

F. Par.

Length 23 Feet $\frac{1}{2}$ or ——— 23.50

Breadth 13 Feet $\frac{1}{2}$ or ——— 13.50

117500

7050

2350 *yds. Ft. inc.*

9)317.2500(35 2 3

27

047

Content is 35 Yards 45

2 *Feet* 3 *Inches* 02 foot.

More Examples.

Breadth	$4\frac{1}{2}$ feet	Length	22 ft.	11 Yards
Breadth	$15\frac{1}{4}$ feet	Length	$19\frac{1}{2}$ ft.	33 Yards
Breadth	10 feet	Length	30 ft.	33 Yards $\frac{3}{10}$
Breadth	19 feet	Length	29 ft.	61 Yards $\frac{1}{4}$

PROB. VI. *The meaſuring of Plaiſterers and Painters Work by the* Sliding-Rule.

Example 1. *Of Plaiſtering.*

LET there be a Ceiling plaiſtered, whoſe Length is 25 Feet 3 Inches, and the Breadth 15 feet 6 Inches: Set 9 on the *double Scale* B, to $25\frac{1}{4}$ on the *double Scale* A; then againſt $15\frac{1}{2}$ on the *double Scale* B, is 43 Yards and almoſt a half, on the *double Scale* A, which is the Content.

Example 2. Of Paving.

Let there be a piece of a Paving 34½ Feet long, and 12½ Feet broad; ſet 9 on B, to 34½ on A, then againſt 12½ on B, is almoſt 48 Yards the Content.

PROB. VII.

THE meaſuring ſuch Superficies as are meaſured by the ſquare of 10 Feet (*viz.* 100 Feet in a Square; for if you multiply 10 by 10 it makes 100) ſuch as *Flooring*, *Roofing*, *Partitioning*, *Tyleing*, &c.

By the Sliding-Rule.

The *Rule.* Set 100, or 1 in the middle, to the Length; againſt the Breadth is the *Content.*

Example.

There is a Floor whoſe Length is 61 Feet and a half, the Breadth 14 Feet and a quarter, ſet 100 on B, to 61½ on A; then againſt 14¼ on the *Double-Scale* B, is 8 Square ¾ on the *Double-Scale* A, for the Content, being 8 Square 75 Feet.

Decimally.

Multiply the Length by the Breadth, and from the Product cut off two more Decimals than is in the Length and Breadth, the Figures remaining are the Squares.

Example. *F. Par.*

Length 61½ Feet or in Foot-meaſure — 61.50
Breadth 14¼ Feet or in Foot-meaſure — 14.25

30750
12300
24600
6150

Content 8¾ Squares, and 76 Feet — 8.763750

By *Contraction* the ſame *Example* is thus,

Breadth 14¼ Feet is in Foot-meaſure Feet 14.25
Length 61½ Feet, or 61.5. inverted is 5.16

8550
142
71

Product (cutting off 3 places is) Squares 8.763

More Examples.		*Contents.*
Length 42 feet	Breadth 24½ feet	10 ſquares 29 feet
Length 64 feet	Breadth 29 feet	18 ſquares 56 feet
Length 86 feet	Breadth 35½ feet	30 ſquares 53 feet

Deductions in this Problem.

In *Carpenters-Work*, you are to deduct for all *Well-holes* in your *Flooring*, for all *Chimney-hearths*, and the like.

Alſo in *Partitioning*, Deductions muſt be made for all *Doors* and *Windows* that are meaſured in.

In *Roofing* make no Deductions for *Window-ſhafts*, or *Sky-Lights*, because they are more Trouble to the Workman than the Stuff is worth that would cover them.

CHAP.

CHAP. V.

Having in the former Part of this Treatiſe ſhewed the Meaſuring all manner of Superficies, likewiſe all ſorts of Regular Figures: I ſhall now give you ſome Inſtructions for the taking the Dimenſions of Trees, or Round Timber, and ſo proceed to the Meaſuring of ſuch, and all manner of Solids.

THE Tree being cut down, the Cuſtom is to gert it, as is ſhewed in the beginning of the next *Chapter*, and for the Length they account from the But-End, up ſo far as the Tree will hold half a Foot Gert when twice folded.

The Dimenſions being taken, the Tree is to be meaſured by *Chapter* the ſixth, as ſquare Timber.

If the Tree have great Boughs that will hold half a Foot Gert, ſuch Boughs are called *Timber*, and they are meaſured and are added to the whole.

1. *Note*, If round, rough *Timber* be meaſured for Sale; the common Way among Artificers in allowing for Rind or Bark is thus: if the Gert or fourth part of the Circumference of the Tree be $\frac{50}{100}$ or half a Foot, they allow $\frac{05}{100}$ or half Inch half quarter. If the fourth part of the Circumference be

be a Foot, they allow $\frac{10}{100}$ or one Inch and almoſt a quarter; if one Foot $\frac{1}{2}$ Gert $\frac{15}{100}$ or an Inch and above three quarters for the Bark, *&c.* But for *Beach*, *Elm*, *Aſh*, and ſuch that is thin bark'd, then the Allowance muſt be a ſmall matter leſs.

2. I have ſeen great Difference in the Gert of a Tree in the Space of two Feet, or leſs, and that hath been generally where one or two Arms have been cut off: In ſuch a Caſe it is neceſſary to Gert the Tree twice or thrice, if there be any great Difference, or otherwiſe there will be Loſs to the *Buyer* or *Seller*. Again, they ſay the *Buyer* hath Priviledge to Gert any where between the Middle and the Ground End, if it be for his Advantage.

Laſtly, The *Content* of any piece of *Timber* being ſound in Feet, if divided by 50, you have the *Content* in Loads: But ſome will have a Load to be 40 Solid Foot, therefore you may take which of the two is moſt cuſtomary with you. The Reaſon why the Difference is, they ſay, becauſe it is ſuppoſed that 40 Feet of round Timber, or 50 Feet of hewn Timber, weigh about a Tunn, or twenty Hundred Weight, which is commonly accounted a *Cart-Load*.

CHAP.

C H A P. VI. *The Meaſuring of* Round Timber *the common Way.*

TAKE the Length in Feet, Half-Feet (and if deſired) in Quarters, then meaſure half way back again, where Gert the Tree with a ſmall Chord or Chalk-line: Double this Line twice very even. This fourth part of the Gert or Circumference (I call the Gert) meaſure in Inches, Halves, and Quarters of Inches; but be ſure the Length be given in Feet, *&c.* and the ſide of the Square or Gert in Inches.

So you have always three Numbers given, to find the fourth, *viz.* 12 on the Gert-line for the firſt, the Length in Feet always for the ſecond, and the Gert or Side of the Square for the third, in Inches, Halves and Quarters.

Now we come to the *Rule.* Set 12 on the Gert-line *D*, to the Length (in Feet, *&c.*) on the Double-Scale *C*, then againſt the ſide of the Square on the Gert-line *D*, in Inches, Halves and Quarters) you will find, on the Double-Scale *C*, the Content.

Note, This Rule is General.

Example 1. Suppoſe the Gert of a Tree in the middle be 64 Inches, and the Length 31 Feet, what is the Content? Set 12 on the Gert-line *D*, to 31 Feet on the Double-ſcale *C*;

then againſt 16, the one fourth of 64, on the Gert-line *D*, is 55 Feet, the Content on the Double-Scale *C*.

2. A piece of Timber is 15 Feet long, and one fourth of the Gert 42 Inches: Set 12 on the Gert-line *D*, to 15 on the ſecond Length of the Double Scale *C*; then againſt 42 at the beginning of the Gert-line *D*, is on the Double Scale *C*, 184 Feet the Content, reckoning the firſt 1 at the Beginning of the Line of *Numbers* (or Double-ſcale) to be 100, the 8 Grand Diviſions 80, the two ſmall ones 4; ſo accounting all together makes (as I ſaid before) 184 Feet.

3. A Length is 9 Feet three quarters, and one fourth of the Gert 39 Inches, ſet 12 on the Gert-line *D* to 9¾ on the Line of Numbers *C*, and againſt 39 at the Beginning of the Gert-line *D*, is 103 Feet the Content on the Double-ſcale of Numbers *C*.

4. The Length 9 Inches; the Quarter of the Gert is 35 Inches. Now becauſe the Length being not one Foot, meaſure it by your Line of Foot-meaſure; and ſee what part of a Foot it makes, a Foot ſuppoſed to be divided into a hundred Parts: Or do thus, ſet 12 on the Double-ſcale *B*, to 100 on the Double-ſcale *A*, then againſt the Length in Inches, namely, 9 on the Double-line *B*; is 75 on the Double-ſcale *A*, for the Decimal or part

of a Foot: Then ſet 12 on the Gert-line D, to 75 in the firſt Length of the *Double-ſcale* C, then againſt 35 on the Gert-line D, is 6 Feet $\frac{4}{10}$, or almoſt half a Foot on the *Double-ſcale* C, for the *Content*.

5. A *Rail* is 16 Feet long, the Quarter of the Gert 3 Inches; ſet 12 on the Gert-line D, to 16 on the firſt Length of the *Double-ſcale* C, then againſt 30 (now called 3,) on the Gert-line D, is juſt 1 Foot the Content, on the Double-line C.

More Examples.

One fourth of the Gert or ſide of the Square in theſe Examples is	The Length in feet	The Content in Feet and Parts are
11 Inches	$40\frac{1}{2}$	34 feet
16 Inches	$39\frac{1}{2}$	70 feet $\frac{2}{10}$
14 Inch. $\frac{1}{4}$	50	68 feet
21 Inches	48	147 feet $\frac{0}{10}$
8 Inch. $\frac{3}{4}$	$26\frac{1}{2}$	19 feet $\frac{4}{10}$
31 Inches	24	160 feet

In taking all the Dimenſions in *Foot-meaſure*, it's performed by the *Sliding-Rule* ſooner than by *Inches*, thus count 10, 20, 30, 40, *&c.* on the *Gert-line* to be 1, 2, 3, 4, *&c.* in *Foot-meaſure*, and then place 10 on the *Gert-line* D, to the Length of the Tree, on the *Double-line* C; and againſt the Gert in *Foot-meaſure* on the *Gert-line* D, ſtandeth the *Content* on the *Double line* C.

1. *Example* before mentioned. A Tree in Length 31 *Feet*, and Gert 64 Inches, or *Feet* 5 $\frac{32}{100}$ it's fourth is Foot 1 $\frac{30}{100}$, what's the *Content*?

Set 10 on the *Gert-line* D, to 31 Feet on the *Double-line* C; then againſt 1 *Foot* 33 *parts*, on the *Gert-line* D, is 55 *Feet* on the *Double-line* C, which is the *Content* as before.

2. A piece of Timber 15 Feet long, and one fourth of the Gert 42 Inches, or Feet $3\frac{5}{10}$, what's the *Content*.

Set 10 on the *Gert-line* D, to 15 on the firſt part of the *Double-line* C; then againſt 3 Feet 5 Tenths, on the *Gert-line* D, is 184 Feet on the *Double-line* C, the *Content* requir'd. Again,

3. A Length is $9\frac{3}{4}$ Feet or 9 Feet, $\frac{75}{100}$, and one fourth of the Gert 39 Inches, or 3 Feet $\frac{25}{100}$: Set 10 on the *Gert-line*, to $9\frac{75}{100}$ on the *Double-line* C; and againſt $3\frac{25}{100}$ on the *Gert-line* D, is beyond 100 on the Double-line C: In ſuch Caſes take half the Length, and then the Content muſt be doubled. As here,

Set 10 on the *Gert-line*, (to the half of $9\frac{75}{100}$) $4\frac{87}{100}$, and then againſt $3\frac{25}{100}$ is $51\frac{5}{10}$, the double is 103 Feet, the Content requir'd.

4. The Length 9 Inches or $\frac{75}{100}$ of a Foot, the Quarter of the Gert 35 Inches or 2 Feet $\frac{92}{100}$ ſet 10 on the *Gert-line*, to $\frac{75}{100}$ in the Double-line C, and againſt 2 Feet $\frac{92}{100}$ in the *Gert-line*, is 6 Feet $\frac{4}{10}$ on the Double-line C, the Content required. Again,

5. A *Rail* 16 Feet long, the Quarter of the Gert 3 Inches, or $\frac{25}{100}$ of a Foot, what's the Content?

Set 10 on the Gert-line, to 16 in the Double-line, then againſt $\frac{25}{100}$ in the Gert-line, is 1 Foot, the Content on the Double-Line C.

And in like manner may all the *Examples* aforegoing, be wrought by the *Sliding-Rule*, if you take the fourth of the Gert in *Foot-meaſure*; for 11 Inches count $\frac{92}{100}$, for 16 Inches count $1\frac{33}{100}$, for 14 Inches count $1\frac{17}{100}$, for 21 Inches count $1\frac{75}{100}$, for $8\frac{3}{4}$ Inches count $\frac{73}{100}$, and for 31 Inches count $2\frac{58}{100}$, and ſo for the Length $40\frac{1}{2}$ Feet is 40 $\frac{5}{10}$, and ſo on for any other, which may be ſeen by the Table of *Foot-meaſure*, or by the Line of *Foot-meaſure* on the *Sliding-Rule*.

If it be required to find the Content of any piece of Timber in Loads, at 40 Feet the Load, uſe half the Gert inſtead of the whole.

Example.

A Length is 15 Feet, and a Quarter of the Gert is 42 Inches; ſet 12 on the Gert-line D, to 15 on the firſt Length of the *Double-ſcale* C, then againſt 21, (which is half of 42 one Quarter of the Gert) on the Gert-line D, is 46 on the *Double-ſcale* C, whereof 4 is 4 Loads, and the 6 multiplied by 4, makes 23

Feet which is 4 Load 24 Feet, or 4 Loads $\frac{6}{10}$

If at any time you have the Content in Loads, and you would have it in Feet; 'tis but multiplying the Content found in Loads by 4, the Square of 2, by which you divided your Gert. So 46 multiplied by 4, is 184 Feet.

If you take the **Dimenſions** in *Foot-meaſure*, you may find the Loads contained in any Timber, thus. If a Length be 15 Feet, and quarter of the Gert 42 Inches, that is 3 Feet $\frac{5}{10}$ whoſe half is 1 Foot $\frac{75}{100}$, then ſet 10 on the Gert-line D, to the Length 15 on the Double-line C, then againſt $1\frac{75}{100}$ (the half of $3\frac{5}{10}$ one quarter of the Gert) on the Gert-line is $4\frac{6}{10}$ on the Double-line C, which is 4 Loads $\frac{6}{10}$, or 4 Loads 24 Feet, the Content required.

If at any time you would know the Content of any piece of Timber by Natural Arithmetick; having gert your Tree, and taken one fourth part for the ſide of the Square, obſerve the following *Rule*.

Multiply the Length of the ſide of the Square in Inches into it ſelf, and that product by the Length in Feet, and the laſt Product divide by 144, the Quotient is the Content in Feet, and if any thing remain, divide again by 12, the Quotient is the odd Inches.

So in Example the Second.

A piece of *Timber* is 15 *Feet long*, the quarter of the Gert is 42 Inches, what is the Content of the Tree ?

The ſide of the Square ——— 42 Inches
Multiplied by it ſelf ——— 42
84
168
The Product is Inches ——— 1764
Multiplied by the Length ——— 15 feet
8820
1764 (feet inc.
144)26460(183.9
144..
1206
1152
00540
432
12)108(9 Inch
108
Content is 183 Feet 9 Inches —— 000

But by *Decimal Arithmetick*, taking all the Dimenſions in *Foot-meaſure*, it's much ſhorter, as follows by the foreſaid *Example*.

Side

F. Par.
Side of the Square 42 Inch. in *Foot-meaſure* 3.5
Multiply it by it's ſelf ——— 3.5
175
105
The Product is ——— Feet 12.25
Multiply it by it's Length ——— Feet — 15
6125
1225
Laſt Product is the *Content* in *Feet* — 183.75
That is 183 *Feet* $\frac{75}{100}$ or 9 Inches as before.

C H A P. VII.

Of the Meaſuring of Round Timber *or* Trees, *the true Way by the* Sliding-Rule *and* Arithmetically.

THE laſt Way is the common Way of meaſuring *Round Timber*, but it giveth not the true Content, for it is always too little, (though it be generally uſed:) I ſhall now give you a Point on the *Rule*, which muſt be uſed inſtead of 12; which Point you may cut with a ſharp pointed Penknife at 10.635, but much better by the *Inſtrument-Maker*.

So in the ſecond Example foregoing.

Let the Length be 15 Feet, the one fourth of the Gert is 42 Inches: Set the ſaid Point (which is 10.635 the true point) to 15 the

Length, then againſt 42, at the Beginning of the Gert-line, is 233 Feet on the Double-ſcale for the Content; whereas the common way giveth but 184 Feet.

Note, That the common Meaſure is to the true Meaſure, as 11 is to 14; ſo that if you ſet 11 on the *Double-ſcale* to the Content found the common Way, 14 ſhall point out the true Content of the ſame; and if you ſet 14 to any true Content, 11 ſhall point out the Content the common Way; this is done on the *Double-line.*

The Gert being taken in *Foot-meaſure*, the point for true Meaſuring is 8862 or $\frac{8852}{10000}$ or more briefly $\frac{89}{100}$, and then for the foregoing *Example.*

The Length being 15 Feet, the one fourth of the Gert 42 Inches; that is, 3 Feet $\frac{5}{10}$ or Feet 3 5 Tenths, I demand the true *Content.*

Set the aforeſaid Point $\frac{89}{100}$, on the *Gert-line* D, to the Length 15 Feet on the *Double-line* C, (in it's firſt Part or Beginning); then againſt Feet 3.5 Tenths (which is 35) on the *Gert-line* D, is 233 Feet on the *Double-line* C, which is the true Content required. Again,

Suppoſe a round Tree in Length 31 Feet, and one Quarter of it's Gert 16 Inches, that is 1 Foot $\frac{33}{100}$, or Foot 1.33 Parts; what's the true Content?

Set 89 on the *Gert-line* D, to 31 Feet on the *Double-line* C, then 1.33 on the *Gert-line* D, points to 70 Feet on the *Double-line* C, the true Content required; whereas by the firſt *Example* of *Chapter* the *6th*, the Content of this Tree is but 55 Feet, by the common way of Meaſuring, which is no leſs than 16 Feet ſhort of Truth.

I ſhall next ſhew how to find the true *Content* of *Timber*, *Arithmetically*, as followeth.

By a *Fixed Number* or *Decimal*, .2821, which multiply by the Gert of the Tree taken in Inches, and from the Product cut off four Figures to the Right-hand, the remaining to the Left-hand, are the Inches for the ſide of the Square equal to the Gert or Circumference of the Tree.

And for underſtanding it, take theſe two or three Examples, how to find the ſide of the Square that ſhall be equal to the Gert or Circumference of the Tree, by this *Fixt Number* 2821, always to be uſed; when the Gert is Inches.

This *Decimal*, or *Fixt Number* is .2821
The Gert in the *2d Example* is —— 168 Inc.

22568
16926
2821

The Product is —— Inches 47.3928

Here the ſide of a Square equal to that *Gert* is 47 Inches and a quarter; for theſe four Decimals cut off, are ſo many parts of 10000, and .3928 is almoſt $\frac{4}{10}$ of a Foot, which is more than a quarter of an Inch.

Another Example.

The fixt Number is ——————.2821
The Gert is ——————————— 48 Inches
22568
The ſide of a Square equal —— 11284
To this Gert is $13\frac{1}{2}$ Inc. or Inc. 13.5408

Another Example.

The Fixt Number is —— —— .2821
The Gert is————————————54 Inches
11284
The ſide of a Square equal —— 14105
to this *Gert* is $15\frac{1}{4}$ Inc. or Inc. 15.2334

I now proceed to work the foregoing piece of Timber or Tree.

Arithmetically.

Multiply the Inches of the Square (with the firſt Left-hand Figure of the four which is cut off) into its ſelf, and that Product by the Length in Feet, and divide the laſt Product by 144, the Quotient is Feet, and the Remainder, if any, divide by 12, the Quotient is Inches.

Example. F. Par.

The ſide of the Square in Inches 47.3

Multiply by it ſelf ——— ——— 47.3

1419

3311

1892

In the Product cut off 2 Decim. 2237.29 Pt.

The Length in Feet ——— ——— 15

11185

2237 (F I.

144(33555(233.3

288..

0475

432

0435

432

The Content of this *Timber* } —— ——

is 233 Feet 3 Inches —— } ——003 Inch

Another Example for Practice.

There is a *round Tree*, whoſe *Gert* is 48 *Inches*, and the *Length* 8 Feet 9 Inches, what is the Content?

Multiply the Inches of the ſide of the *Square* equal to the Gert (with the firſt Figure on the Left-hand of the four cut off) into it ſelf, and from the Product cut off two Figures to the Right-hand, the Remainder multiply by the Inches of the Length of the Tree (and not by the Length in Feet) becauſe the Length is Feet and Inches, therefore you muſt bring your Length into Inches by multiplying them by 12, this laſt Product divide by the Inches that are in a ſquare Foot of Timber, namely 1728, the Quotient is the Feet, the Remainder (if any) divide by 144, the Quotient is the odd Inches.

Example.

The Side of the Square being Inches——13.5
Multiply it by it ſelf—————————13.5
675
F. In.
The Length———8.9 405
Multiplied by———12 135
Makes————105 Inches——182.25
The Length in Inches is————105 Inch.
910
1820

The Content of this round Tree is 11 Feet, and 102 remains, which is not one Inch.

1728)19110(11 F.
1728
01830
1728
0102

Note, The fix'd Number 2821 is the ſide of a Square, that's equal to a Circle whoſe Gert is 1 Inch, or 1 Foot, or 1 any Thing.

Alſo the Number 10.635 is the ſide of a Square that's equal to a Circle whoſe Diameter is 12 *Inches*.

Alſo .8862 (or ſhorter .89) is the ſide of a Square that's equal to a Circle whoſe Diameter is 1 Foot, or 1 any Thing.

Now to perform this Arithmetically, when all the Dimenſions are taken in Foot-meaſure.

The *Rule.* Multiply the whole Gert by the Fix'd Number .2821, and the Product is the ſide of a Square equal to that Gert; then multiply that Product by it ſelf, and this laſt Product multiply by the Length of the Tree, and it produceth the Content required.

Example. Let the Length be 15 Feet, and the Gert 14 Feet. I demand the true Content?

The fix'd Number is —— —— —— .2821
Multiply by the Gert 14 Feet, inverted is — 41
2821
1128
The Product is the ſide of the Square Ft. 3.949
Multiply by it ſelf inverted is - —— 949.3
11847
3546
156
27
The Product is the Square —— Feet 15.576
Multiply by the Length 15 Feet, inverted — 51
15576
7785
The Product is the Content —— Feet 233.61
That is 233 Feet $\frac{61}{100}$ or 233 Feet 7 Inches.

Another

Another Example for Practice.

A round Tree, whoſe Gert is 48 Inches, or 4 Feet, and Length 8 Ft. 9 Inc. or 8 Ft. $\frac{75}{100}$

The fix'd Number is———————————— .282
Multiply by the Gert 4 Feet———————— 4
Product is the ſide of the Square —Foot 1.128
Multiply by it ſelf, inverted is ———— 8.211
1128
112
22
8
The Product is the Square ——— Foot 1.270
Multiply by the Length 8.75, inverted is 57.8
10160
889
60
The Product is the Content ——Feet 11.109

CHAP. VIII.

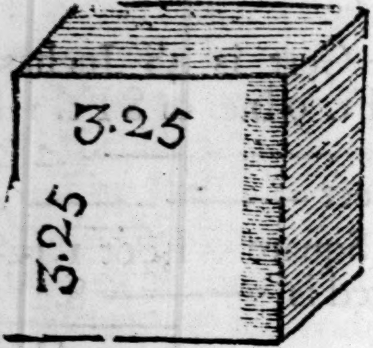
To meaſure the CUBE.

LET there be a Cube whoſe ſides are 3 Feet 3 Inches, what is the Content?

By the Sliding-Rule.

Set 12 on the Gert-line D, to 3¼ on the Double-ſcale C; then againſt 39 Inches the ſide of the Cube on the Gert-line D, is 34 Feet and ¼ on the Double-ſcale C, the Content required

Decimally.



F. Par.
The ſide 3 ft. 3 in. or.3.25
Multipl. by the ſame 3.25
1625
650
975
The 1ſt *Prod.* is 10.5625
Multipl. by the ſame 3 25
528125
211250
316875
The Content is 34⅓ Feet or — Feet 34.328125

But by Contraction *thus,*

F. Par.
The ſide of the Cube 3 Feet 3 Inches or—3.25
Multiply by 3 Feet 25 Parts, inverted is 52 3
975
65
16
The firſt Product called the Square, is Ft. 1056
Multiply by 3 Feet 25 Parts, inverted is—52.3
3168
211
53
The Content 34⅓ Feet as before,——Ft. 34.32
CHAP.

CHAP. IX.

To meaſure Timber that is neither round, nor Square; but firſt to find a Mean Proportional betweeu any two Numbers.

TO find this *Mean Proportional*, ſet the greater of the two Numbers on the *Gert-Line*, to the ſame on the *Double-Line* of Numbers; then again, the leſſer on the *Double-Line* of Numbers, is the Mean Proportional on the *Gert-Line*; or ſet the leſſer on the *Gert-Line*, to the ſame on the *Gouble Line* of Numbers; then againſt the greater on the *Double-Line* of Numbers, is the Mean *Proportional* on the *Gert-Line*; any one of theſe will do.

Note, Examples of this are in the next *Problem*.

PROB. I.

To meaſure unequal ſquared Timber, that is, when the Breadth and Depth are not equal.

Meaſure the Length of the Piece in Feet and the Breadth and Depth, (at the End) in Inches. Then find the Mean Proportional between the Breadth and Depth of the Piece as is taught (in *Chap.* 9. and) in the Example following. The Mean Proportional is the ſide of a Square equal to the End of the Piece; which having found the Piece may be meaſured as Square Timber.

Example I.

In a piece of Timber whoſe Length is 13 Feet, the Breadth 23 Inches, and the Depth 13 Inches; ſet 23 on the Gert-line D, to 23 on the Double-ſcale C; then againſt 13 on the Line C is 17.35, or $17\frac{1}{3}$ on the Gert-line D, then ſetting 12 on the Gert-line D, to 13 Feet the Length on the Line of Numbers C, then againſt $17\frac{1}{3}$ (the *Mean Proportion)* on the Gert-line D, is 27 Feet the Content required.

Example II.

In Stone, which let it be 7 Feet 40 parts, or 7 Feet and about 5 Inches in Length, and 30 Inches in Breadth, and $23\frac{1}{2}$ deep; ſet 30 Inches on the Gert-line D, to 30 on the *Double-ſcale* C; then againſt $23\frac{1}{2}$ on the *Line of Numbers* C, is $26\frac{1}{2}$, or 26.50 on the *Gert-line* D: Then ſet 12 on the Gert-line D, to 7.40, on the Line C, then againſt $26\frac{1}{2}$ on the *Gert-line* D, is 36 Feet the Content on the *Double-ſcale* C.

The Content of theſe two Examples by Arithmetick, is thus,

The firſt Example.

Let there be a piece of Timber whoſe *Length* is 13 *Feet*, the Breadth 23 *Inches*, and the Depth 13 Inches.

The

The Rule.

Multiply the Breadth in Inches, by the *Depth* in Inches; and that Product multiply by the *Length* in *Feet*, and divide the laſt Product by 144, the Quotient is *Feet*, and the Remainder (if any) divide by 12, the Quotient is *Inches.*

Example.

The Breadth 23 *Inches.*
The Depth 13 *Inches.*
69
23
The *Product* 299
Multiply by 13 *Ft.*
897
299
144)3887(26 *Ft.*
288
1007
864
12)143(11 *Inches.*
12
023
12
11 Remainder is $\frac{11}{12}$ of an Inch

Note, This Example by the *Sliding-Rule* was 27 *Feet* by Arithmetick it wants 1 *Inch*; for it is 26 *Feet*, 11 *Inches.*

By Foot-meaſure it's done thus:

	F. Par.
Breadth 23 Inches in *Foot-meaſure* is	1.92
Depth 13 Inches or Feet 1.08 inverted is	80.1
	1.92
	15
The Product is —— —— *Feet*	2.07
Multiply by the Length 13 Feet inverted	31
	207
	62
Content is 26 Feet 11 Inches, or Feet ——	26.9

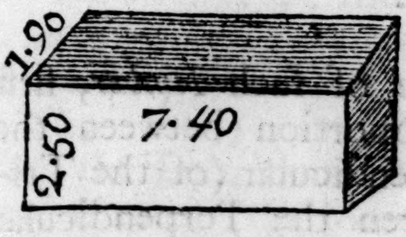
The Second Example, Decimally.

Let there be a piece of Stone 7 Feet 40 parts long, 2 Feet 50 parts in Breadth, and 1 Foot 96 parts in Depth, what is the Content?

The Rule.

Multiply the Length by the Breadth, and the Product by the Depth or Thickneſs; and cut off from the laſt Product, as many places to the Right-hand as there be Decimals in the three Dimenſions, the Integers remaining are Feet.

Example. F. Par.
The Length —— —— —— —— 7.40
The Breadth —— —— —— 2.50
37000
1480



The *Prod.Feet.* 18.5000
The *Depth* Ft. 1.96..
1110000
1665
185
The Content is 36 Ft. 3 Inc. or Ft. 36.260000

By Foot-meaſure it's thus Contracted.

F. Par.
The Stones Length 7 Feet 5 Inches that is 7.41
Stones Breadth 30 Inches or 2.5. inverted is 5 2
1482
370
The Product is—— —— —— Feet 18.52
Depth 23 ½ Inches, or 1.96, inverted is 69.1
1852
1667
111
The Content is 36 Feet 4 Inches or Feet 36.30

PROB.

PROB. II.

To find the Content of a piece of Timber whoſe End is in the Form of a Triangle; and both Ends alike and Equal.

TO find the *Content* of ſuch *Timber*, firſt find a mean Proportion between the Baſe and half the Perpendicular (of the Triangular End) or between the Perpendicular and half the Baſe, both meaſured in Inches. Then is the mean Proportional the ſide of a Square equal to the Triangle.

Then to find the Content, ſet 12 on the Gert-line D, to the Length in Feet on the *Line of Numbers* C, then againſt the mean Proportion on the Gert-line D, is the Content on the *Line of Numbers* C.

But the Dimenſions being all taken in *Foot-meaſure*, and the mean Proportional found in the ſame; then ſet 1 on the Gert-line D, to the Length in the Double-line C; then againſt the mean Proportional in the Gert-line D, is the Content in the Double-line C.

Note, If the two ſides of a Triangle be equal, the other ſide is called the Baſe, but if the three ſides be unequal, the longeſt ſide is the Baſe: From whence the neareſt Diſtance, to the oppoſite Angle, is the Perpendicular.

Examp.

Example. A piece of *Timber* 19 Feet 6 Inches in Length, the Baſe of the Triangle at each End being 21 Inches, and the *Perpendicular* to each *Baſe* being 16 Inches, what's the *Content.*

Set 21 Inches on the *Gert-line* D, to 21 on the *Double-line* C; then againſt 8 on the Line C, is $12\frac{7}{8}$, or 12.95 on the *Gert-line* D, the Mean Proportional.

Then ſet 12 on the *Gert-line* D, to $19\frac{1}{2}$ Feet the Length on the *Double-line* C; and againſt 12.95 (the Mean Proportional) on the *Gert-line* D, is $22\frac{3}{4}$ or (Feet $22\frac{8}{10}$ the *Content* required) on the *Double-line* C. Or thus, take all the Dimenſions in *Foot-meaſure*, and then the Length 19 Feet 6 Inches is 19.5, the Baſe 21 Inches is 1.75, and the Perpendicular 16 Inches is 1.33; now ſet 1.75 on the *Gert-line* D, to 1.75 on the *Double-line* C, and againſt 0.67 on the *Double-line* C, is 1.08 (on the *Gert-line* D) for the Mean Proportional: Then ſet 1 on the *Gert-line* D, to the Length 19.5 on the *Double-line* C, and againſt 1.08 on the *Gert-line* D, is 22.8 (or Feet 22 almoſt 11 Inches) on the *Double-line* C, for the Content, very near to that before.

Arithmetically.

The *Rule*; multiply the Baſe by the Perpendicular (both taken in Foot-meaſure) and half that Product multiply'd by the

Length, produceth the Content required, as in the foreſaid Example.

F. Pa.
The Baſe 21 Inch. or in Foot-meaſure is 1.75
The Perpendicular 16 Inch. or 1.33. inver. 33.1
175
53
5
The Product is —— —— —— Feet 3.33
Half the Product is —— —— —— Feet 1 17
The Length 19 Ft. 6 Inch. 19.5, invert. is 5.91
117
105
6
The *Content* is 22 Feet 10 Inches, or Ft. 22.8

PROB. III. *To meaſure Timber that Tapereth.*

THE Length meaſured in Feet, and note one third of the Length, which may be found by the *Sliding-Rule*, thus; Set 3 on the *Double-Line* A, to the Length on the *Double-Line* B; then againſt 1 on the *Double-Line* A, is the third part on the *Double-Line* B; then if the Solid be round, Meaſure the Diameter at each End in Inches, ſubtracting the leſſer Diameter from the greater, and add half the Difference to the leſſer Diameter, the Sum is the Diameter in the middle of the

Piece; then ſet 13.54 on the Gert-Line *D*, to the Length on the *Double-Line* C, then againſt the Diameter in the middle on the *Gert-Line D*, is a fourth Number on the *Double-Line* C, then ſet 13.54 or 13$\frac{1}{2}$ of the Gert-Line *D*, to the third part of the Length on the *Double-line* *C*; then againſt the half Difference on the Gert-line *D*, is another fourth Number, on the *Double-line* C, theſe two fourth Numbers added together makes the Content

Example. Let the Length be 27 Feet (the one third by the Rule is 9) the greater Diameter 22 Inches, and the leſſer 18 Inches.

See the Operation.

The greater Diameter ——— 22 Inches
The leſſer Diameter ——— 18 Inches
The Sum is ——— 40
The Difference ——— 04
The half Difference ——— 02 } added
The leſſer Diameter ——— 18 }
The Diameter in the middle – 20 Inches.

Then ſet 13.54, or 13$\frac{1}{2}$ on the Gert-line D, to 27 on the *Double-Line* C; then againſt 20 on the Gert-line *D*, is 58.9000, that is 58 Feet $\frac{000}{1000}$ parts.

Again, ſet 13.54 of the Gert-line D, to 9 on the Double-line C; then againſt 2 on the Gert-line (repreſented by 20) is 196 Parts of a Foot.

The firſt fourth Number——58.900 }
The ſecond fourth Number 106 } added
The Sum is the Content ——59.096

Which is 59 Feet $\frac{1}{4}$ Inch.

Note, If the Timber be Wainy, that is neither Square nor Round, take one Wain in and leave the other out.

The ſame done by *Foot-meaſure.*

	F. Par.
The Greater Diameter 22 Inches or ——	1.83
The Leſſer Diameter 18 Inches or ——	1.5
The Sum of both Diameters is —— Foot	3.33
Half is the middle Diameter ——— Foot	1.67
Difference of the Diameter is ——— Foot	0.33
Half Difference of the Diameter is Feet	0.17

Then ſet 1.13 on the Gert-line D, to the Length 27 Feet on the Double-line C; and then againſt 1.67 on the Gert-line D, is 58 Feet $\frac{9}{10}$ Then,

Set 1.13. on the Gert-line D, to 9 Feet, on the Double-line C; and then againſt 0.17 on the Gert-line D, is .196 Parts of a Foot, and both put together is the Content; that is, 58.9 and .196 added makes 59.096, or 59 Feet $\frac{1}{4}$ Inch, as before.

Suppoſe the Solid be Square, and having the ſame Dimenſions; that is Length 27 Feet, the Greater End 22 Inches Square, and the leſſer End 18 Inches Square, what's the *Content?*

F. Par.

		F. Par.
The greater Square	22 — Inches or ——	1.83
The leſſer Square	18 — Inches or ——	1.5
Sum of both Squares	40 — Inches or ——	3.33
$\frac{1}{2}$ is the mid. Square	20 — Inches or ——	1.67
Differ. of the Ends	— 4 — Inches or ——	0.33
$\frac{1}{2}$ Differ. of the Ends	2 — Inches or ——	0.167

Then to find the Content by the Inch-meaſure it's thus. Set 12 on the Gert-line D, to 27 Feet (the Length of the Solid) on the Double-line C; then againſt 20 Inches (the middle Square) on the Gert-line D, is 75 Feet $\frac{4}{10}$. Again ſet 12 on the Gert-line to 9 Feet (one third of the Length) on the Double-line; and againſt 2 Inches (the half Difference of the Ends) on the Gert-line, is $\frac{25}{100}$ parts of a Foot; both together is 75 $\frac{65}{100}$ parts (which is almoſt 8 Inches) the Content of the Solid: Or thus, by Foot-meaſure.

Set 1 on the Gert-line, to the Length 27 Feet on the Double-line, then againſt 1 Foot 67 Parts the (Middle Square) on the Gert-line, ſtands 75 Feet $\frac{4}{10}$, and ſetting 1 on the Gert-line, to 9 Feet (the one Third of the Length) on the Double-line; then againſt 0.167 (the half Difference of the Ends) on the Gert-line, is (on the Double-line) $\frac{25}{100}$ Parts of a Foot, and both together 75 Feet $\frac{4}{10}$ and $\frac{25}{100}$ is Feet $\frac{65}{100}$ part of a Foot as before, exactly agreeing both by *Inch-meaſure* and *Foot-meaſure*; and here note the Numbers that are fix'd in this kind are thus to be underſtood: 13.54057, &c. in ſhort 13.54 is the Diameter of a Circle, whoſe Area or Content is 144 Square Inches: And 1.1283814, &c. in ſhort 1.13 is the Diameter of a Circle whoſe Area or Content is 1 Foot, or 1 any Thing.

PROB. IV.

To find how many Inches in Length will make a Foot Solid at any Gert, being the ſide of a Square, not exceeding 40 Inches.

LET the Gert or ſide of the Square upon the Gert-line be ſet to 1 on the Numbers, then againſt 41.57 of the Gert-line is the Number of Inches on the Numbers that will make a Solid Foot.

Example.

Let the Side of a Square be 7 Inches, ſet 7 on the Gert-line D, to 1 on the Double-line C, then againſt 41.57 on the Gert-line D, is $35\frac{1}{2}$ Inches on the Double-line C, for the Length of 1 Foot Solid.

To do the ſame in *Foot-meaſure*; the ſide of the Square 7 Inches, in *Foot-meaſure* is .58 parts; which ſaid 58 parts on the Gert-line D, being ſet to 1, on the Double-Line C;

then againſt 1 on the *Gert-line* D, is 294, that is 2 Feet 94 parts, or 2 Feet 11¼ Inches for the Length, to make one Foot of *Timber.*

PROB. V.

Having the Diameter of a Circle, or Round Piece of Timber; to find the Side of a Square within the Circle, or to know how many Inches the Side of the Square will be when the Round Timber is ſquared.

The Rule.

Set always 8. 5 on the *Double-line* A, to 6 on the *Double-line* B; then againſt the Diameter on the Line A, is the Side of the *Square* on the Line B.

Example.

Let the Diameter be 18 Inches; ſet 8.5 on A, to 6 on B; then againſt 18 on A, is 12¼ on the *Line* B, for the Side of a Square within that Circle.

The ſame done in *Foot-meaſure*, the *Diameter* being 18 Inches is in *Foot-meaſure* 1.5; Then ſet 1 on the *Double-line* A, always to .707 or .71 almoſt, on the *Double-line* B; then againſt the Diameter 1.5 on the *Double-line* A, is 1.7 on the *Double-line* B; that is Foot 1.7 Tenths the ſide of a Square within a Circle, whoſe Diameter is Foot 1.5 Tenths. And here note the given Numbers 8.5, and 6 (but more truly 1, and .707) are, one the Diameter

ter of a Circle, the other the ſide of a Square within that Circle.

PROB. VI.

By having the Gert of a Tree, or round Piece of Timber, to find the Side of a Square within.

The Rule.

Set 10 to 9 on the Line A and B, then againſt the *Gert* on the Line A, is the Inches for the ſide of the Square on the Line B.

Example.

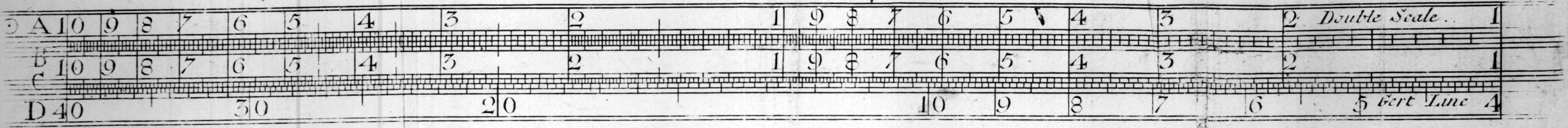
Let the Gert be 16 Inches, Set 10 on the Line A, to 9 on the Line B; then againſt 16 on the Line A, is 14$\frac{1}{4}$ on the Line B, for the ſide of the Square.

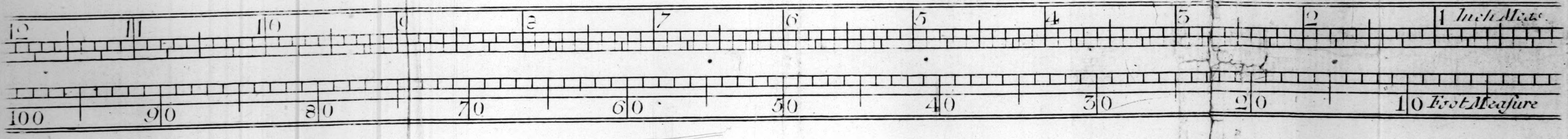
By *Foot-meaſure* it's thus; the Gert 16 Inches, is Foot 1.33 parts; then ſet 10 on the *Double-line* A, to 9 on the *Double-line* B, and againſt the Gert, 1.33 on the *Double-line* A, is on the *Double-line* B, 1.19, that is 1 Foot 19 Parts, which is 1 Foot 2$\frac{1}{4}$ Inches, for the ſide of the Square within.

And *Note*, The Numbers 10 and 9, or 1 and 9, ſhews when the Square within the Circle is 1, the fourth part of the Circumference $\frac{9}{10}$ parts of the ſame.

By

Coggeſhall's Rule for Menſuration


A 10 9 8 7 6 5 4 3 2 1 9 8 7 6 5 4 3 2 Double Scale 1
B
10 9 8 7 6 5 4 3 2 1 9 8 7 6 5 4 3 2 1
C
D 40 30 20 10 9 8 7 6 5 Gert Line 4


12 11 10 9 8 7 6 5 4 3 2 1 Inch Meas.
100 90 80 70 60 50 40 30 20 10 Foot Meaſure

By theſe two laſt Problems you may know (before a piece of Timber is hewn) how many Boards or Planks of any Thickneſs it will make.

PROB. VII.

By the fourth part of the Gert of Round Timber, to find the ſide of a Square equal to it.

The Rule.

Set 1 on the Line A, to 1.128 on the Line B; then againſt the (one fourth of the whole) Gert on the Line A, is on the Line B, the ſide of the Square equal to it?

Example. Let the Gert (that is the one fourth of the whole Gert) be 16 Inches; how much is the ſide of the Square equal to it?

Set 1 to 1.128, but ſhorter to 1.13, on the Lines **A** and B; then againſt 16 on the Line A, is 18 on the Line B; which ſheweth that a Square whoſe ſide is 18 Inches, is equal to a Circle whoſe Gert is 64 Inches, or one fourth of its Gert is 16 Inches.

By *Foot-meaſure*, the *Rule* being ſet as beſore, 1 againſt 1.13, then againſt Foot 1.33 parts (equal to 16 Inches) you will find 1.5, that is 1 Foot $\frac{5}{10}$, equal to 1 Foot 6 Inches, the ſide of a Square equal to the given Gert, the ſame as before.

CHAP. X.

To meaſure Brick-Work.

BRick-*Work* is meaſured by the *Rod* of 16 Feet and a half, whoſe Square is $272\frac{1}{4}$, which ſheweth that the Point on the *Double-line* is $272\frac{1}{4}$, but 272 being marked on the *Rule* will ſerve (without any conſiderable Error) a Brick and a half thick, and is the fix'd Number.

An Example.

There is a *Brick-wall* whoſe Length is 564 Feet, the Height is 10 Feet and $\frac{1}{2}$: Set 272 on the *Double-line* A, to 564 on the Line B; then againſt $10\frac{1}{2}$ on the Line A, is $21\frac{7}{10}$ ***Rod***, the Content on the *Double-line* B.

Note 1. Always the Fix'd Number that goeth with the Queſtion is called the firſt *Number*, which you may ſet to either of the other Numbers.

Note 2. That $272\frac{1}{4}$ Feet makes a *Rod* of *Brick-work*, at a *Brick* and a half Thickneſs: if it be thicker fewer Feet go to a *Rod*; if thinner the more.

If you demand how many Feet makes a *Rod* at two *Bricks* Thickneſs: Two being the firſt or fix'd Number that goeth with the Queſtion muſt be ſet to $1\frac{1}{2}$; then againſt $272\frac{1}{4}$, is about 204, *viz.* 204 Feet $\frac{19}{100}$, and ſo for any other Thickneſs, for which

Take

Take this General Rule.

Set 1½ to any Thickneſs; then againſt 272¼ on the ſecond *Length* is the *Number* of *Feet* that makes a *Rod* to that Thickneſs, and is called the Firſt Number for that Thickneſs, as in the *Table* following.

By this Table, made by the ſame *Rule*, by the *half Brick*'s Thickneſs of the Wall, you have the firſt *Number* by Inſpection: as thus, againſt 2 *Bricks* ½ or 3 half *Bricks* thick, is 163 *Feet*, for a Square *Rod*, and ſo for any other.

Half Bricks thick.	Square Feet in a Rod on the Superficies.	Half Bricks thick.	Square Feet in a Rod on the Superficies
½. 1	817 Feet	3 ½. 7	117 Feet
1. 2	408 Feet	4. 8	102 Feet
1 ½. 3	272 Feet	4 ½. 9	91 Feet
2. 4	204 Feet	5. 10	82 Feet
2 ½. 5	163 Feet	5 ½. 11	74 Feet
3. 6	136 Feet	6. 12	68 Feet

CHAP. XI.

Meaſuring of LAND.

LAND is uſually meaſured by the *Pole*, *Perch* or *Rod*, which is 16½ *Feet* long; 40 *Poles* in Length and 4 in Breadth makes an *Acre*, ſo that an *Acre* of *Land* contains 160 *ſquare Poles*, half an *Acre* is 80, and a quarter is 40.

Some uſe a *Pole-Chain*, and others a 4 *Pole-Chain*, the beſt for Uſe is that of 4 *Poles*. This *Chain* is called *GUNTER*'s *Chain*. It is divided into 100 Links or Parts, every Link is 7 Inches and 92 Parts of an Inch in Length.

PROB. I. *By the Pole-Chain*, There is a Plot of Ground 35 Pole or Perch broad, and 185 Pole long, how many Acres is the Content?

By the Sliding-Rule.

Thus, Set 160 to the Breadth, then againſt the Length is the Content.

Example.

Set 160 on the *Double-line* A, to 35 the Breadth on the *Double-line* B; then againſt 185, the Length on the Line A, is 40$\frac{45}{100}$ (that is 40 Acres and almoſt $\frac{1}{2}$) on the *Double-line* B; the Content.

Arithmetically.

The Rule. Multiply the Length in Poles by the Breadth in Poles, and divide the Product by 160 (the Poles in an Acre) the Quotient is the Acres, if any remains, divide again,

$$\text{By}\left\{\begin{matrix}120\\18\\40\end{matrix}\right\}\text{the Quotient is}\left\{\begin{matrix}\frac{3}{4}\\\frac{1}{2}\\\frac{1}{4}\end{matrix}\right\}\text{of an Acre.}$$

Example

Example

The Length ——— ——— ——— 185 *Poles*
The Breadth ——— ——— ———35 *Poles*

```
        925
       555
  16|0)647|5(40 Acr
       64
  ————————
  4|0)007 5(1 quar
        4
  ————————
        35 Poles
  (remaining
```

But 75 *Poles* remaining after the firſt Diviſion, *viz.* by 160, which 75 being divided by 40 the laſt Remainder is 35, which makes the *Content* 40 *Acres* 1 *Quarter* and 35 *Poles*, or almoſt 40 *Acres* & $\frac{1}{2}$.

More Examples by the Rule.

Breadth Pole.	Length Pole	
42	49	12 Acres $\frac{86}{100}$ or 12 $\frac{3}{4}$.
53	64	21 Acres $\frac{2}{10}$ or 21 $\frac{1}{4}$.
64	85	34 Acres juſt.

P R O B. II.

By the four Pole Chain. There is a Plot of Ground containing 16 *Chains* 25 *Links in Breadth, and* 57 *Chains* 30 *Links in Length, what is the Content of that Piece of Land ?*

By the Sliding Rule.

The Rule. Set 10 on the *Double-line*, to the Breadth in *Chains* and *Links* on the other, then againſt the Length in *Chains* and *Links* is the *Content ?*

Example.

Set 10 on the *Double line* A, to 16.25 on the *Double-line* B, then againſt 57.30 on the *Double-line* A, is 93 Acres and ſomething more, for the Content on the *Double-line* B,

Arithmetically.

Length —— Chains 57.30 Links.
Breadth —— Chains 16.25 Links
28650
11460
34380
5730
Acres 93.11250 cut off five Figures
4
no Roods — |45000
40
Poles—— 18|00000

Note, 4 *Roods* make an *Acre*, and 40 *Poles*, *Perches* or *Rods* makes one *Rood* or *Quarter* of an *Acre*.

More Examples by the Rule.

Breadth	*Length*	
3,35	15,32	5 *Acr.* a little more.
4,53	16,42	7½ *Acres* almoſt.
16,28	72,51	118 *Acres.*

Note, *Gunter's Chain* containeth four *Statute Poles* in 100 *Links*, ſo that any Number of *Chains* is no more than ſo many 100 *Links*; as 4 *Chains*, is 400 *Links*, 6 *Chains* is 600

Links, &c. and 160 Square Statute Poles is an Acre, each Pole being 16 Foot and a half. Therefore in a ſquare Chain is 16 ſquare Poles. If you divide 160 (the ſquare Poles in an Acre) by 16 the (ſquare Poles in a Chain) the Quotient is 10, the ſquare Chains in an Acre.

A Square Chain contains 10000 Square Links (for it is 100 multiplied by 100) and conſequently an Acre is 100000 Square Links.

Therefore the Reaſon of the foregoing Operation is evident, for if you multiply 5730 Links by 1625 Links, the Product will be 9311250 Square Links. Divide 9311250 by 100000 (the Square Links in an Acre) the Quotient is Acres, and the Remainder is Parts of an Acre. But to divide by 100000 is no more than to cut off five Figures to the Right-hand, ſo will the remaining Figures to the Left-hand be Acres, and thoſe cut off to the Right-hand 11250, are parts of an Acre: Again multiply thoſe five Figures cut off from the Right-hand of the Product, by 4, and from the Product cut off five Figures to the Right-hand, thoſe on the Left-hand will be Roods, and if thoſe cut off be multiplied by 40, and from the Product five Figures be cut off from the Right-hand, thoſe on the Left-hand, are Poles or Perches.

So in the preceding Operation there is 93 Acres, no Roods 18 Perches ſor the Content.

PROB. III.

How to reduce Statute-Meaſure to Cuſtomary, and the contrary.

ACcording to a *Statute* made in the 33*d* of *Edward* the I. and likewiſe in the 25th of *Elizabeth*, a Statute Pole is 16 Feet and a half long. Now divers parts of *England* uſes a Pole of 18 Feet long, and ſome a Pole of 21 Feet long, and others a Pole of 24 Feet long. Therefore to turn one ſort of Meaſure into another; ſuppoſe *Statute* into *Cuſtomary*, do thus; multiply any Number of Acres, Roods and Perches *Statute Meaſure*, by the Square half Yards, or Square half Feet, in a ſquare Pole of *Statute-Meaſure*, the Product divide by the ſquare half Yards, or ſquare half Feet in a Pole of the *Cuſtomary-meaſure*, the Quotient gives you the Acres, Roods and Perches of that *Cuſtomary-meaſure*; as for *Example.* In 172 Acres *Statute-meaſure*, how many Acres of 18 Feet to the Pole or Perch?

In a Statute Pole or Perch, there is five Yards and a half, that is 11 half Yards; conſequently in a ſquare *Statute* Pole there is 121 ſquare half Yards, and in a ſquare Pole of 18 Feet, there is 144 ſquare half Yards,

172 Acres Statute Meaſure.
121 Square half Yards in a Statute Pole.
172
344
172
144)20812(144 Acres Cuſtomary and $\frac{76}{144}$.
144
0641
576
0652
576
076 Overplus.

Therefore the Cuſtomary Acres (at 18 Feet to a Perch) is 144 $\frac{76}{144}$ of an Acre the Overplus multiply by 4, and the Product divide by 144 gives Roods; again, multiply the Remainder by 40, and the Product divide by 144, the Quotient will be Perches; as by the following Operation of the preceding Remainder.

76 Overplus, or Remainder.
4
144)304(2 Roods
288
016
40
144)640(4 Perches.
576
064

So that 172 Acres Statute Meaſure is 144 Acres, 2 Roods and 4 Perches, with a ſmall Remainder (not worth notice) of *Cuſtomary Meaſure*, of 18 Feet to the Pole or Perch.

If there had been any given Roods and Perches with the Acres, then you muſt turn all into Perches, and having multiplied and divided as before directed, divide the Quotient by 160, or 40, and that Quotient again by 4.

PROB. IV.

In 543 *Cuſtomary Acres, at* 18 *Foot to the Perch, how many Acres of* Statute-Meaſure?

543 Cuſtomary Acres.
144 ſquare ½ Yards in a cuſtomary *Acre,*
2172
2172
543
121)78192(646 Statute *Acres*
726
0559
484
0752
726
26 Remainder multiplied.
by 4
104 no Roods
40
121)4160(34 Perches
363
530
484
046 Remains

Here you ſee that in 543 Cuſtomary Acres at 18 Feet the Perch there are 646 Acres, no Roods, 34 Perches Statute-Meaſure and $\frac{46}{121}$.

Cuſtomary Acres as well as Statute Acres, contain 160 Square Perches, the bigneſs is only in the bigneſs of the Perch.

CHAP. XII.

The Deſcription and Conſtruction of Scamozzi's *Lines upon the Two-Foot Rule, with their Uſe in all the neceſſary Problems preparatory to the Practice of Building.*

1. THE moſt uſeful Line of all is a Scale of equal Parts, beginning at 0 at the Center or Joint of the Rule, and proceeding to 30 near the remote end of it on both ſides; at which on each Leg of the Rule there is a Braſs Point or Center-Pin fix'd, and as theſe 30 Diviſions are intended in general to repreſent 30 Foot, they are every one ſubdivided into 12 equal Parts, every one of which repreſents an Inch; but they may be apply'd to any other Meaſure.

2. Next to this, and above the 30 Scale is the 40 Scale, or the ſame Length divided into 40 equal Parts, and each into 6 Subdiviſions, ſo that if the Diviſions be Feet, the Subdiviſions are each of them 2 Inches.

3. On the other Joint of the Rule, and next without the 30 Scale is a Line of Chords with a Center-Pin, at 60 equal to 15 on the 30 Line, and ſo proceeding to 180, where there is another Center-Pin at the end of the Line.

4. Next to the Line of Chords is a Line of Tangents beginning at 0, and continuing to the Tangent of 45, which is the Radius of every Circle.

5. The Vacancy left by the ſpreading of the 30 Scale is ſupply'd by the Line of *Polygons*, it begins at 2 at the remote end of the Scale, and reckons inwards in ſome Scales to 20; but it is now thought ſufficient to continue it to 12, to prevent the Confuſion upon the Scale which would otherwiſe be occaſion'd by the Contraction of the Lines and the decreaſing Diſtance of the Numbers towards the Center.

Before I give a further Account of the Uſe of *Scamozzi*'s Lines, it will be proper to explain the Terms made uſe of in Building, ſo far as it relates to the Uſe of thoſe Lines; as,

1. A Model or Modul is the Diameter of a Pillar or Column, and a Minute is the 60th Part of a Model in any Order; as ſuppoſe the Diameter of a Column or Pillar be 18 Inches, then 18 Inches is a Model, and 3 Tenths is a Minute: and hence, if a Column of 18 Inches Diameter be 7 Models, 12 Minutes, it's Heighth is 10 Foot, 9 Inches, 6 Tenths.

2. In the Uſe of the Sector, or which is the ſame of *Scamozzi*'s Lines which come to the Center or Joint of the Rule, the Word *Lateral* ſignifies an Extent taken from the Center of the Scale to the Number propos'd, ſet off upon either Limb of the 30 Scale as Lateral 17 is the Extent from the Joint or Center of the Rule to 17 on the 30 Scale on either Limb; but a Parallel Extent is from any Number upon one Limb to the ſame upon the other: Thus at whatever Opening the Rule is ſet, the Extent from 17 on one Limb to 17 on the other is call'd a Parallel Extent of 17, *&c.* The Proportion between the Lateral and Parallel Extents upon the Sector, and conſequently upon *Scamozzi*'s Lines are fully demonſtrated, *Euclid Lib* VI *Prob.* II. and IV. and upon that Foundation we may build the following general Rule which is univerſally true in the Uſe of all Sectoral Lines, whether equally divided or not, *viz.*

That every Lateral is to its Parallel, as any other Lateral is to its Parallel; the Sector or Rule being kept at the ſame Extent or Opening: Therefore in all Proportions in Common Numbers to be perform'd by *Scamozzi*'s 30 Scale; the Rule is this.

Make the Lateral Second Term a Parallel in the firſt, then ſhall Parallel Third Term be Lateral Fourth required.

Example. As 18 to 24, ſo 12 to what? Make Lateral 24 a Parallel in 18, then ſhall Parallel 12 be Lateral 16; the Anſwer, or to be more plain, extend the Compaſſes from the Center in the Joint of the Rule to the ſecond Term 24, and keeping that Extent in the Compaſſes, open the *Sector* ſo as that Extent may reach from 18 on the 30 Scale on one Leg, to 18 on the 30 Scale on the other Leg of the Rule; then keeping the Rule at the ſame Opening, extend the Compaſſes from the Third Term 12, on one Limb of the Rule, to 12 on the other Limb, that extent apply'd from the Center or Joint of the Rule along the 30 Scale, will reach to 16 the Anſwer requr'd; and this being the Method of working all direct Proportions either in Lines or Numbers, I need not repeat Examples.

The Uſe of *Scamozzi's* Lines in ſeveral neceſſary Problems.

PROB. I. *To divide a Given Line leſs than two Foot into any Number of equal Parts, as ſuppoſe a Line of* 7 *Inches is to be divided into* 17 *equal Parts.*

TAke 7 Inches in your Compaſſes and make it a Parallel in 17 upon the 30 Scale, then ſhall the Parallel of 10, 12, 15, *&c.* repreſent their reſpective Numbers of Parts upon the Line of 7 Inches propoſed to be divided. The Uſe of this is, if I would repreſent a Garden of 28 Yards ſquare, upon a piece of Paper of 3 Inches ſquare, take 3 Inches off the Scale and make it a Parallel in 28, and keeping the *Scale* at that Opening the Parallel of 5, 6, 10, *&c.* ſhall repreſent the ſame Number of Yards upon the Paper, or to any Number under 30; but if a Number above 30 be required to be laid down upon a Line of 7 Inches: As ſuppoſe 48, take the half of it, *viz.* 24 makes the given Line 7 Inches a Parallel in 24; then ſhall every Parallel repreſent its double, as the Parallel of 9 repreſents 18; and if the Line was to be continued beyond 48, the Method is the ſame, for the Parallel of 30 would be the Meaſure of 60, *&c.* and by this Means without a Multiplicity of Problems any Scale to any Draught may be made either to meaſure, or lay it down by.

PROB. II. *To ſet the 30 Scale at any Angle propos'd, or being ſet in any Poſition to know what Angle one 30 Line makes with the other; and firſt to ſet it at Right Angles, or a perfect Square.*

Make Lateral 90 of the Chords, a Parallel in 15 on the 30 *Scale*; then does the two 30 *Scales* make a Right Angle.

Or take 10 off the 30 Scale in your Compaſſes, and ſetting 1 Foot in 8, open the Rule till the other Foot will fall in 6 on the ſame *Scale*, and then the two 30 Lines ſtand at Right Angles. *Euclid. Lib.* 1. Prob. 47. Or make Lateral 21 Foot 2 Inches a Parallel in 15, it produces the ſame.

To ſet the Rule to any Angle propos'd; as ſuppoſe of 50 Degrees, make Lateral 50 of the Chords a Parallel in 15 on the 30 *Scale*, and it is done; and to know what Angle the Rule lies open at in any Poſition, make Paralell 15 on the 30 Line a Lateral upon the Chords, and that gives the Angle requir'd.

PROB. III. *To find a mean Proportional between any two Numbers given, or in plainer Terms, to find an Intermediate Number, whoſe Square is equal to the Product of the two given Extreams.*

Set the 30 Scale at Right Angles by *Prob.* 2. and take off the Lateral half Sum of the two given Numbers, and with this Extent, and one Foot in the Lateral half Difference of the two given Numbers, obſerve where the other Foot falls upon the 30 Scale on the other Leg of the Rule, for that is the mean Proportional required. Thus the mean Proportional bebetween 4 and 16 is 8, becauſe 4 times 16 is equal to the Square of 8, or as 4 to 8, ſo 8 to 16.

Note, One Uſe of the mean Proportional, among many others is, in meaſuring Solids, whoſe Breadth and Debth are not equal, for in that Caſe the mean Proportional between the Breadth and the Depth is equal to the ſide of the Square, and to be uſed as ſuch in all Caſes where the ſide of the Square is a Term uſed to find the Content.

PROB. IV. *Of Superficial Meaſure, and firſt the Breadth of a Plank given, to find how much in Length makes a Foot.*

Make Lateral 12 a Parallel in the Breadth, and letting the Rule continue ſo, take off Parallel 12, and that apply'd laterally gives the Length of a Foot.

Example. At 9 Inches broad make Lateral 12 a Parallel in 9, then ſhall Parallel 12 be Lateral 16, the Length of a Foot requir'd.

2. *The Breadth of a Board given in Inches, and the Length in Feet, to find the Content in Feet.*

Make Lateral Length in Feet a Parallel in 12, then ſhall Parallel Breadth be Lateral Content in Feet.

Example. Breadth 8 Inches, Length 18 Foot, make Lateral 18 a Parallel in 12; then will Parallel 8 make Lateral 12 the Content in Feet.

PROB. V. *Of ſolid Meaſure for Timber; and firſt at any Number of Inches ſquare, to know how much in Length makes a Foot.* N. B. *If a Piece of Timber be not ſquare, make it ſquare by help of a mean Proportional, as in* Prob. 3. *and uſe that as if it was the ſide of the Square.*

Make Lateral ſide of the Square a Parallel in 12 (always) and keeping the Rule at that Opening makes Parallel ſide of the ſquare a Lateral fourth Number. Again, make Lateral 12 a Parallel in that fourth Number, then will Parallel 12 be Laterally the Number of Inches to make a Foot.

Example. At 9 Inches ſquare, how much in Length makes a Foot. Make Lateral 9 a Parallel in 12, then will Parallel 9 be Lateral $6\frac{3}{4}$. Again, make Lateral 12 a Parallel in $6\frac{3}{4}$, then will Parallel 12 be Lateral $21\frac{1}{3}$ Inches to make a Foot of Timber.

2. The ſide of the ſquare in Inches, and the Length in Feet given to find the Content in Feet and Inches.

Make Lateral ſide of the Square a Parallel in 12 (always) then is the Parallel Length a Lateral fourth Number——Again, make the Lateral fourth Number a Parallel in 12, then is Parallell ſide of the ſquare the Lateral Content in Feet.

Ex. Suppoſe a piece of Timber be 20 Foot long, and 9 Inches ſquare, make Lateral 9 a Parallel in 12, then is parallel 20 (the Length) a Lateral fourth Number, *viz.* 15. Then make Lateral 15 a Parallel in 12, then is Parallel 9 a Lateral 11¼ the Content in Feet required.

CHAP. XIII.

The Uſe of the foregoing Problems in Building, viz. *in finding the Lengths and Angles of Raſters, Hips and Collar-Beams in any Square, or Bevelling Roof at any Pitch.*

IN order to the better underſtanding the following Directions, it is neceſſary to obſerve, that *True Pitch is when the Raſter is juſt three Quarters the Breadth of the Frame or Houſe*, and to find it readily ſeek the Breadth of the Houſe upon the 40 Scale, and againſt it you will find on the 30 Scale the Length of the Raſter requir'd, three Quarters of which is (nearly) the height of the Perpendicular from the raiſing Piece to the Top of the Gable, which is ſound on the Rule by looking for the Length of the Raſter on the 40 Scale, and againſt it on the 30 Scale is the Perpendicular of the Gable requir'd.

Example. Let the Houſe be ſuppos'd 16 Foot broad, the Raſters according to this Proportion are to be 12 Foot long, and the Perpendicular will be 9 Foot.

Note, This Proportion is not exactly or mathematically true for making half the Breadth of the Houſe which is 8, the Baſe of a Right-angled Triangle; the Length of the Raſter 12, the Hypothenuſe; and the Perpendicular of the Gable 9, the Perpendicular of the Triangle: The Sum of the Squares of the Legs is 145, but the ſquare of the Hypothenuſe 12, is but 144, whereas they ſhould be equal, *Euclid. Lib.* 1. *Prob.* 47. but the Difference is ſo inſenſible that it is thought ſufficiently exact in Practice.

To avoid Multiplicity of Schemes and Problems, as to Square, Bevelling or Hipt Roofs, I ſhall include as much Variety as can be intelligibly done in one; and firſt,

PROB. I. *The Conſtruction of a Roof or Frame that has one end Square and Upright, and the other Bevel and Hipt.* See *Fig.* 1.

Let P M F G repreſent the Frame of a Houſe whoſe Gable end P M is ſquare, and the other end F G is Bevel and Hipt, and let the Square end P M be 12 Foot, the ſide M G 23 Foot, the Bevel and G F 13 Foot 6 Inches, and the ſide

F P 16 Foot 6 Inches ; take P v three fourths of the Breadth of the Frame P M in your Compaſſes, and one Foot in P draw the Arch b, and with the ſame Extent and one Foot in M croſs the Arch b in b, and draw M b and and P b for the Length of the Rafters 9 Foot, Biſſect P M in a, and F G in n, and draw n a, continued to b, then n a repreſents the Ridge of the Houſe, and a b 6 Foot 9 Inches, (¾ of the Rafter P b which is 9 Foot) is the Perpendicular of the Gable.

Take F n or n G in your Compaſſes, and ſet from n to C, and through C draw F K and G I, which will always croſs each other at Right Angles in C, draw S T Perpendicular to a n, and continued both ways to R and V, and draw k l Parallel to F G, both thro' the Center C.

To find the Length of the Hips.

Take the Perpendicular a b, and ſet from C to I and K 6 Foot 9 Inches, and draw K G and F I ; with the Extent F I, and one Foot in F make the Arch Y, and with the Extent G K and one Foot in G croſs the Arch Y in Y, then draw G Y, it is the longer Hip, and F Y is the ſhorter.

Continue the Line P M both ways to Q and Z, and ſet the Rafter's Length M B or P B from M to Z and from P to Q, as alſo from S to R, and from T to V, and draw Z V and Q R, then is P M b the Gable end, P F R Q one ſide of the Roof; M Z V G the other ſide of the Roof, and G Y F the Hipt Roof of the Level end; and if the Frame P M G F were ſuppos'd to lie Horizontal, and the Gable P M b ſet perpendicular upon the Line PM. The ſide of the Roof M Z V G folded in the Line M G, and the ſide P Q R F fold up in the Line P F, the Line Z V and Q R will Co-incide and form the Ridge of the Roof, and the Points R and V will meet perpendicular to the Point C; and if the Roof of the Hipt Bevel end F G Y be folded up in the Line F G, the Point Y will alſo meet with R and V, and compleatly cover the Roof, and the Rafters, Hips, *&c.* may be cut to their reſpective Lengths by the Scale by which the Frame was made, and the Rafters at 12 or 14 Inches aſunder, or more or leſs may be repreſented by the Lines m n, m n, *&c.* parallel to Q P and M Z.

To find the back of the Hips to make them anſwer both the ſides and end of the Roof; and firſt, to find the back of the longeſt Hip G K.

Lay a Scale from n to l, it cuts the Diagonal C G in x; ſet one Foot of the Compaſſes in x and extend the other to the neareſt Diſtance to the Line K G, and ſet that Extent from x to y, and draw the Lines l y and y n and they form the Angle of the Back of the longer Hip, and in like manner lay a Scale from k to n, it cuts F G in d, ſet the Compaſſes from d the neareſt diſtance to F I, and ſet that Extent from d to r, and draw k r and r n, they make the Angle of the Back of the leſſer Hip.

But if for private Reaſons the perpendicular Height of the Roof and the Breadth of the Frame be given or determin'd, and by that means the Roof is above or under true Pitch, increaſe or diminiſh the Perpendicular a b according to the given Perpendicular of the Gable, and form the Rafters Hips, &c. accordingly.

Example. Let the Breadth of the Frame be P M as before 12 Foot, but the Perpendicular is limited to 4 Foot 9 Inches, then is a d 4 Foot 9 Inches the Perpendicular, and M d 7 Foot 7 Inches the Length of the Rafter equal to which M Z muſt be made; and from this Foundation proceed in all Reſpects as above directed.

From what hath been ſaid a General Rule may be form'd for Roofing of all Frames, whether above or under true Pitch, the Perpendicular and Breadth being given, or if true Pitch, the Perpendicular being found by the foregoing Directions, which being known,

known, the Method of performing by Scamozzi's Lines is as follows; And in order thereto ſet the 30 Scales at Right Angles by *Prob* 2. *Pag*. 82. then,

1. *To find the Length of the Rafters.*

Count half the Breadth of the Houſe on one Leg, and the Length of the given Perpendicular on the other Leg (both on the 30 Scale) the Parallel Diſtance between them meaſured laterally gives the Length of the Rafter requir'd.

2. *To find the Length of the Hip.*

Reckon the Length of the Rafter now found on one Leg, and half the Breadth of the Houſe on the other Leg, the parallel Diſtance between them meaſured laterally gives the true Length of the Hip requir'd.

3. *To find the Diagonal Line.*

Set off half the Breadth of the Houſe on both Legs, and the parallel Diſtance between them meaſured laterally gives the Diagonal requir'd.

4. *By the Diagonal given to find the Length of the Hips, by a Method different from that in Article.* 2.

Set the Diagonal off of one Leg, and the Perpendicular Height on the other, and the parallel Diſtance between them meaſured laterally gives the Length of the Hip requir'd.

Theſe four laſt Articles are ſo plain, that I ſuppoſe they need no Example.

But if the Square end be to be hipt, obſerve the following Rules, continue the Perpendicular a b to q, making a q equal to M Z, or Q P the Length of the Rafter, and draw M q and P q, and ſet the half Breadth a M or a P from a to t, then is a q the longeſt Rafter of the hipt end, M q and P q the Hips, t the Foot of the King-poſt, perpendicular to which i, q, and i, will all meet in a Point when folded as before propoſed, and then will the Length of the Ridge be only V i, which will co-incide with R i, as will i P with P q, and i m with M q, then will m o and n o be ſhort Hip Rafters, and P Q i and M z i which were of uſe only when the Square end was ſuppoſed Perpendicular are now of no uſe at all.

By Scamozzi's *Lines to find the Hips*, and Heighth of the King-poſt.

Set the 30 Lines at Right Angles, then ſet half the Breadth of the Houſe a M on one Leg, and the Length of the Rafter a q equal to M Z on the other Leg (both laterally from the Center, the parallel Diſtance between theſe two Points meaſured laterally gives the Length of the Hip requir'd. But to find the Heighth of the King-poſt (having the 30 Scale ſet at Right Angles) take the lateral Length of the Rafter a q in your Compaſſes, and ſetting one in the half Breadth of the Houſe reckon'd laterally from the Center, turn the other Foot, and obſerve where it cuts the 30 Scale on the other Leg, for that reckon'd from the Center laterally is the Heighth of the King-Poſt requir'd.

To find the Rafters, Hips and Angles in Frames that Bevel and are Hipt at both Ends, and are broader at one End than the other. See *Fig.* 2.

In thoſe ſort of Frames the middle Breadth is the Guide for the Length of the Rafters, for the Perpendiculars at each End are to be alike and equal to the middle Perpendicular; but in this Caſe the Rafters at the broad End muſt be leſs, and thoſe at the narrow End more than three fourths of the Breadth of their reſpective Ends, if they ſtand ſquare to keep the Ridge of the Houſe upon a Level or Parallel to the Horizon; in order to which let A B C D repreſent the Frame of the Houſe or Plan it ſtands upon, bevelling at both Ends both at A B and C D; where note if the two ſides and two ends be given as A D and B C, as alſo A B and D C, yet it is neceſſary to have one of the Angles to regulate the reſt. Then Biſſect AB in G, and DC in Z, and draw ZG the Line over which the Ridge of the Houſe is to be, and upon that Line ſet AG from G to I, and CZ from Z to F; through F draw rq parallel to DC, and through I draw tv parallel to AB, then through I draw the Diagonals Am and Bk, which will always cut each other at Right Angles; through F alſo draw the Diagonals Dn and CK, which will alſo cut each other at Right Angles Croſs.

Find the middle of the Line ZG as at g, in which croſs ZG at Right Angles with the Line xh, three fourths of which xs is the Length of the middle Raſter bC or Cd. Now to find the Length of the Hips, and firſt for the Hips ſtanding upon the Angles A and B, AI and BI repreſent the Diſtance of the Foot of the King-poſt from the reſpective Angles A and B, alſo IH is by Conſtruction equal to the Perpendicular of the Roof or Height of the King-poſt; therefore in the Right Angled Triangle AIH, in which AI is the Baſe, IH is the Perpendicular, AH is the Hipothenuſe, from thence called the Hip of the Houſe, therefore AH and BH are the Length of the two Hips for the Angles A and B, and if AV be made equal to AH, and BV equal to BH; theſe two Lines join'd in V the Triangle, ABV exactly repreſents the Roof of the Bevel end AB from Hip to Hip, and by the ſame Rule the Hips of the other end DC are found to be D E and C E, and the end of the Roof to be repreſented by the Triangle C E D; and if the Hips be meaſured in the Scheme by the ſame Scale by which they were protracted their Length may be exactly determin'd from thence.

For the Angles for the Back of the Hips, I refer the Reader to the Directions for the Bevel end of a Houſe in the Explanation of *Fig*.I.

The following Propoſitions perform'd by *Scamozzi*'s Lines.

To find the Length and Angles of every principal particular Rafter in Frames broader at one End than the other.

The Perpendicular being the ſame in all parts of the Houſe as hinted before, open the 30 Scale ſquare, and ſetting one Foot of the Compaſſes in the Heighth of the Perpendicular in one Leg of the 30 Scale, and ſet the other Point in the half Breadth of the Frame on the other Leg, that extent of the Compaſſes meaſured laterally from the Center, gives the Length of the Rafter requir'd, and to find the Angles lay a Rule to the Compaſs Points, whether *Scamozzi*'s or any other joint Rule, and ſet a Bevel, and it ſhews the Angle at the Raiſing-piece, or at the Ridge of the Houſe, to cut the Ends of the Rafters by.

To

To find the Length and Angles of Collar Beams in any Roof.

Take the whole Breadth of the Frame in your Compaſſes meaſured laterally on the 30 Scale, and keeping the Compaſſes at that Extent, ſet one Foot in the Length of the Rafter on one Leg, and the other in the Length of the Rafter on the other Leg that Extent, meaſured laterally on the 30 Scale gives the Length of the Raiſing-piece within the Rafters; then at what Heighth above the Raiſing-piece you intend the Collar-Beam ſhall be, if you lay a Ruler parallel to the Line between the two Points of the Compaſſes that Rule ſhall repreſent the Collar-Beam (allowing ſpare Wood for the Tenons) or if it be an Extent of another pair of Compaſſes it is the ſame, meaſured laterally on the 30 Scale gives the Length of the Collar-Beam requir'd.

For the ſides CBTS and DQPA with the length of their Rafters, &c. See *Prob.* I. *Page* 87. the Manner of performing being much the ſame as in the bevelling Hipt Roof, *Fig.* I.

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